FAR OUT!

by Lili Wilkinson

FAR OUT!

by Lili Wilkinson

My name is Stella Kaufman, and this is my last minute on Earth.

We're all strapped into our seats on the spaceplane – me and my five-year-old brother Cosmo in the cabin, and Mum in the cockpit. We won't be here for long – it takes six hours to get to the Lunar Gateway, where Mama is waiting for us at our actual spaceship. The one we're going to be living on for the next four years with a small team of engineers and geologists.

Cosmo looks like he's going to barf. He'd better not – throwing up in space isn't anything like doing it on Earth. If you spew in microgravity, it floats around and gets everywhere. It's dangerous, as well as super gross.

I hand him one of the special spew-bags that's tucked into the console between our seats, but he shakes his head, so I put it back.

Mum looks over her shoulder at us. 'You two ready?'

I nod and grin, but Cosmo just looks vaguely green and clutches Hadfield, the toy frog I made him, tightly to his chest.

Our whole family is obsessed with space. My mums are both astronauts – Mum is a pilot and Mama is an engineer. My grandmother was an astronaut. My whole life has been spent looking up at the stars, and in eight minutes and forty-two seconds, I'm actually going to be up there.

They're calling us the Callisto Four. We're not the first family to go to space. People go to space all the time – tourists and engineers and scientists. There are kids living at the Lunar Gateway, and on the Martian Outpost.

But we're the first family to go to Callisto, one of Jupiter's moons. The first family to go further than Mars. Our mission is to set up a brand-new outpost. It's going to take us four years to get there, and then another year working on the surface before the first ship full of residents arrives. I'll be nineteen by then.

At the press conference before we left, a reporter asked me if I was sad to be missing out on regular teenage life – hanging out with friends and going on dates and stuff. I just laughed. Everyone gets to do those things. But I'm the only teenager who gets to go to Callisto. The only teenager who gets to wake up every morning and see the endless glittering spread of space out my bedroom window.

Won't you get bored? the reporter had asked.

Bored? In space? I don't think so. I've got my robotics kit – my goal is to have built a fully functional support robot by the time we get there.

Robotics! the reporter had replied. That's cool.

I could tell he thought I was just a little kid playing pretend, not a fourteen-year-old who has won the State Junior Robotics Fair three years in a row. Anyway, I don't care, because Mission Control just gave Mum the okay to launch. I am going to space, and that boring reporter has to stay on Earth. Ha!

'Stella?' It's Cosmo, his voice small and frightened. 'Can you make Hadfield dance?'

Hadfield was my Robotics Fair-winning project last year. Cosmo loves him, and I'm pretty proud of his programming. He can move all his limbs, hop, and even dance.

I make a series of gestures on my watch, and the speaker inside Hadfield starts to emit a thumping bass rhythm as Cosmo's favourite song, 'Galaxy Vibes', begins to play. Hadfield sways in time with the music before leaping into the sequence of dance moves that made this song famous.

Spin, spin, reach for the stars, far... out!

Cosmo sings along and does the moves as best he can around his seatbelt. I'm glad he's distracted as the engines beneath us ignite with a roar. My heart starts to pound.

It's finally happening.

Goodbye, Earth.

Hadfield spins and spins, then reaches his arms up, before falling flat on the floor with a splat, his arms and legs spread out wide.

Far... out!

I've heard about this part, and I've watched heaps of videos and done VR sims of it. I thought it wouldn't be a big deal. And I've been on high-speed planes before. I know that swooping sensation when a plane takes off, where your stomach kind of feels like it's been left behind and your bum goes all tingly.

This feels *nothing* like that.

An olden-days astronaut once said that lift-off was essentially the same as getting strapped to an exploding bomb.

He wasn't wrong.

I feel like I've been punched by a giant fist and we're shooting up and up and up into the sky. The engines are so loud I can't hear anything else, except for the very faint strains of 'Galaxy Vibes' coming from Hadfield.

Spin, spin, reach for the stars, far... out!

The spaceplane is shaking and shuddering. I'm afraid it's going to break apart and we're all going to plummet back down to the ground in bits.

I glance over at Cosmo, who has his eyes screwed shut. I feel so heavy, like I'm being buried alive under wet sand. I can barely breathe.

There are two terrifying explosions, and now I'm certain we are going to die, even though I'm pretty sure it's just the rocket boosters decoupling from the spaceplane. Is it supposed to sound like that?

Mum looks back at me and says something, but I can't hear her over the roar. She smiles encouragingly, but I can't tell if it's a *don't worry this is normal* smile, or a *looking at my daughter one last time before we all die* smile.

But then the boosters drop away and suddenly the roaring noise, the shuddering and shaking, the incredible weight pressing on my chest – all of it has stopped.

Everything is perfectly still. My ears are ringing in the sudden quiet. My bum lifts off my seat and my seatbelt tightens, stopping me from floating away.

Hadfield comes rising up from the floor, except I guess it isn't the floor anymore. Up and down don't exist in microgravity.

'Welcome to space,' says Mum with a grin, as she pushes off from the pilot's chair and floats towards us.

It feels like the spaceplane isn't moving, but Mum assures me that we are in fact travelling at 28,000 kilometres per hour, and then tells me some stuff about our vestibular systems and gravity that I don't really listen to, because I am in space.

In *space*!

I click my own seatbelt off and feel my body drift into the air. Cosmo rises up beside me and grabs Hadfield right out of the air, and for a few moments we all enjoy the feeling of weightlessness.

'Hadfield wants to do a space dance!' Cosmo says, and I make the gesture on my watch.

Hadfield wriggles and grooves in microgravity, and we all do the moves with him.

Spin, spin, reach for the stars, far... out!

We can't fall on the floor on our bellies the way we usually do at the end, because there is no floor, and no gravity to make us fall. But it's even more fun this way, spread out wide and floating. Is this how stingrays feel all the time?

Mum twirls around, and I notice that the stitching in her flight suit has come loose, just over her shoulder. I make a mental reminder to tell her later, so she can fix it.

We got to choose the colour of our suits. Mum's is blue. Mine is purple.

Mama's is green and Cosmo's is yellow. Back in the beginning of the space program, the suits were huge and bulky, but now it's just like wearing a regular jumpsuit. They use nanofibres to regulate the temperature inside. We

still have to wear a MAG though – a Maximum Absorbency Garment, also known as a Space Nappy. There's no toilet on the spaceplane and it'll be six hours. I'm hoping the journalist I spoke to doesn't know about that part.

Space travel is so glamorous.

'Mum, catch!' says Cosmo, and he sends Hadfield twirling and spinning slowly through the air towards her.

As he does so, the spaceplane makes a little shudder, and a beeping noise sounds on the pilot's console. Mum turns her head to look at it, and misses Hadfield, who sails past her into the cockpit.

'Just some space debris,' she says, floating over to the console and tapping the screen. 'Nothing to worry about.'

But she's wrong, because a moment later the ship makes a sudden lurch, and all the lights turn red. We get thrown against the upper wall of the spaceplane.

'Ow!' says Cosmo, but he's okay.

'Don't panic,' says Mum, which is exactly the kind of thing you say to make people panic. 'There was more debris than expected. We've been knocked slightly off course. I need to do some calculations to adjust our trajectory.'

Cosmo looks over at me, his expression full of concern. I smile brightly at him. 'Nothing to worry about,' I tell him.

But I am worried.

Just the slightest change in our course could mean we miss the Lunar Gateway by thousands of kilometres and go hurtling into space in a spaceplane that is in no way equipped for long-haul travel.

I take a deep breath. Mum is one of the best pilots in the world. There's a reason why they chose our family to go to Callisto. She'll get us back on course.

Cosmo starts to pull himself along the wall towards the cockpit. 'I want Mum,' he says.

I grab his ankle and haul him back. ‘Mum has to concentrate on some maths stuff for a minute to make sure we get back on track. We should get in our seats and buckle up.’

The spaceplane is juddering a little, like we’re still being peppered with space junk.

The World Space Coalition has done a good job of cleaning up the junk that humans left in low-Earth orbit. Most of the big stuff is gone now, swept away by robotic arms or caught in giant nets. But there are still hundreds of millions of small pieces of debris from old satellites and other space missions. And just a tiny fleck of paint, travelling at 28,000 kilometres per hour, can be enough to damage a spaceplane or a satellite.

‘You kids all right?’ Mum asks over her shoulder. Her fingers fly across the touchscreen, running complicated simulations to make sure we get safely to the Lunar Gateway.

Cosmo is sniffling. ‘I want Hadfield,’ he whimpers.

'Shh,’ I tell him. ‘Don’t be such a baby. Just let Mum do her thing.’

Mum hears us. ‘It’s okay,’ she says, reaching up to pluck Hadfield from where he’s floating above her head.

She uses one of the handrails to propel herself towards us, but before she can go very far, the hatch between us and the cockpit closes with a *whoomp*, sealing us off from her.

Cosmo lets out a noise that is somewhere between a scream and a wail.

A calm female voice comes over the intercom. ‘*Hull breach detected in cockpit. Cabin pressure dropping.*’

Hull breach.

A hole.

A bit of the space junk has made a hole in the spaceplane. I see Mum’s hair starting to blow around her face as her helmet visor comes down. She lets go of Hadfield, and gestures at us to put our helmet visors down too, just in case.

I help Cosmo with his, because he's crying properly now.

'It's going to be fine,' I tell him. 'Mum is going to finish the course correction, then she'll find and plug the hole. Think of the story we'll have to tell Mama over dinner tonight!'

But Cosmo isn't listening to me. He's pressed right up against the double perspex window that now separates us from Mum.

'Come on,' I tell him. 'We have to get into our seats.'

The cockpit looks like it has been hit by a freak gust of wind. I can see Mum's seatbelt whipping around like a snake, and Hadfield is dancing jerkily in the air. But we can't hear any of it, not even the alarm. Everything in the cabin is totally silent and still. It's kind of spooky.

Mum says something to us, but it seems like the intercom in her flight suit isn't working, because I can't hear her. She turns back to the touchpad, and that's when I see it.

The loose stitching on Mum's flight suit is now a hole. It must have come apart when the space debris first hit us.

'Mum?' I say into the intercom. 'Mum? Can you hear me?'

She doesn't look up from the console.

I shove Cosmo out of the way and start to bang on the perspex hatch between us. 'Mum!' I yell. 'Look over here!'

But she can't hear me.

Cosmo has gone quiet. 'Stella?' he says, his voice all wobbly. 'Stella, what's wrong? Aren't we supposed to be getting into our seats?'

I don't answer him. I don't know how to tell my little brother that our mother is in a rapidly depressurising cabin with a ripped spacesuit, and unless she does something to patch the hole very, very soon, she is going to run out of oxygen and pass out, and then... well, I don't want to think about what happens then.

I can see the hole in the spaceplane hull, right opposite us. It's about the

size of a dollar coin. You wouldn't think something so tiny would cause much damage, but all the oxygen in the cockpit is streaming out of it, and fast.

Finally, Mum turns away from the touchpad, and pushes herself over to the equipment cupboard that lines one of the cockpit walls. She opens a drawer and pulls out a thin black plastic square, and I breathe a sigh of relief. She's got an emergency patch for the hull. All she needs to do is peel off the sticky backing and slap it over the hole. Then the cockpit will repressurise and she'll be fine, and we can head off to the Lunar Gateway and start our adventure.

'You can do it, Mum!' I yell, even though she can't hear me.

She hesitates for a moment, looking down at the emergency square with a puzzled frown on her face. Then it slips from her gloved fingers. She looks up at me, and I gesture to my own shoulder and point at her.

Her frown deepens, and she puts a hand to her shoulder, near where the tear in her suit is, understanding dawning on her face.

'Just patch the ship!' I yell.

Mum reaches out for the patch, which is spinning and tumbling in the wind created by the hole, but she can't close her fingers on it. I see her breathing fast now, her cheeks flushed. She's concentrating so hard, but without enough oxygen, she can't quite get her body to do what she's telling it to do.

'What's wrong with her?' Cosmo asks.

'She can't breathe,' I whisper. 'There isn't enough oxygen left in the cabin.'

Mum's eyes droop closed, and her whole body goes limp.

My own body feels like it's been plunged into ice water.

Mum isn't moving.

'Is she dead?' Cosmo asks in a very small voice.

'No,' I tell him, trying to sound reassuring. 'She just fainted.'

But if she doesn't get some oxygen in the next three minutes, she will probably die. And if Mum dies, what happens to me and Cosmo?

It doesn't seem fair that our adventure is ending here, barely fifteen minutes after it began. We were supposed to be the first family to go to Callisto. We've barely made it out of low-Earth orbit.

I have to do something.

But what? If only I had a... a sewing robot in there that could fix the tear in Mum's flight suit. Or a medical robot that could put an oxygen mask over Mum's face.

But I don't have anything.

'I want Hadfield,' Cosmo whimpers.

I blink. There is a robot in the cockpit.

Hadfield.

He's floating up by the ceiling, getting battered around by the wind.

I can't get Hadfield to fix the tear in Mum's suit. And I can't get him to administer oxygen to her.

Hadfield only knows how to do one thing.

I touch a finger to my watch, and Hadfield scrabbles against the roof of the cockpit. He moves a few inches to the left. I move my finger in another direction, and he scrabbles down a little.

'Stella, what are you doing?' Cosmo asks.

'I just need to get him in the right position,' I say.

I have no idea if this will work.

Hadfield is still getting battered by the wind in the cockpit, but I'm learning to calculate how to push against it, and when to let it take him.

'Stella, he's getting close to the hole!' Cosmo says. 'What if he gets sucked into space?'

I can't bear to look at Mum, floating motionless in the air. I'm running out of time.

‘He won’t fit through the hole,’ I explain. ‘And the difference in pressure isn’t enough for him to get sucked through it anyway.

‘Okay, Hadfield,’ I mutter. ‘Time to dance.’

And I make a gesture.

The music plays through my watch as well as through Hadfield’s speaker, so we can hear ‘Galaxy Vibes’ start up with its familiar thumping bassline.

Hadfield moves and wiggles to the music as it builds to the chorus.

‘Spin, spin,’ I say, as Hadfield twirls around and around.

He’s so close now. Almost in position.

‘Reach for the stars!’ Cosmo says, his eyes wide, as Hadfield reaches his little froggy arms up over his head.

Cosmo and I look at each other, then back at Hadfield.

‘Far... out!’ we yell together.

Hadfield flattens himself out, as flat as a stingray, and flops onto his belly.

Right over the hole.

My hand grips Cosmo’s, squeezing so tight that he yelps.

This has to work.

It has to.

Is Hadfield flat enough? Will his rubbery belly seal the hole? It’s no adhesive patch, but hopefully the difference in pressure will keep him held tight against it.

The song finishes, and we wait for an agonising thirty seconds. Then the calm female voice sounds over the intercom again.

‘Hull breach repaired,’ she says. ‘Cockpit pressure restabilising.’

I let out a whoop of victory. It worked!

Cosmo gives me a huge hug, and then we wait another minute for the oxygen levels in the cockpit to return to normal. The perspex hatch slides open and we tumble through it, reaching up to Mum.

I press the release button on her visor and look at her face.

It's so familiar to me. Every line and freckle.

She's my mum, and she just has to be okay.

Her eyelashes flutter a little, then she opens her eyes.

I hold my breath.

'What happened?' Mum asks, blinking. 'Are you kids okay?'

'Hadfield saved you! Stella made him dance over to the hole and, look!' Cosmo points up at Hadfield. 'Far... out!'

Mum laughs and wraps us both in a big hug. 'Far out, indeed,' she says. 'That was some quick thinking, Stella. You're going to be a great astronaut.'

I grin. I don't think I want the rest of our space adventure to be quite as eventful as the first fifteen minutes, but... I can do this.

I'm ready to see the universe.

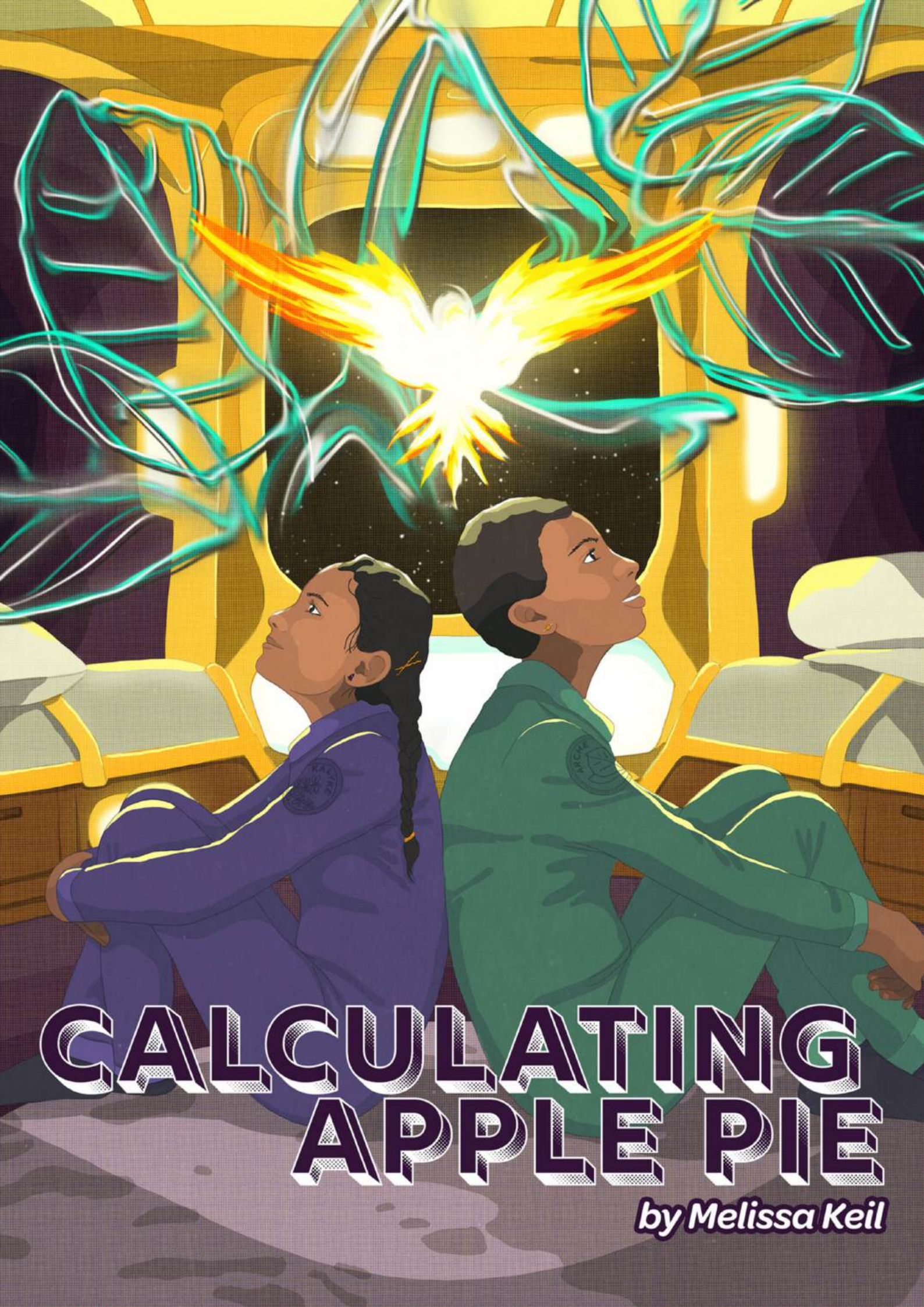
Far Out! is the first story in The Callistan Cycle as part of Imagining The Future.

Far Out! by Lili Wilkinson
Story Editor Kate Whitfield
Artwork by Cassandre Collins

Imagining The Future is a program of Future You.

See you in the future!

FUTURE
you


CALCULATING
APPLE PIE
by Melissa Keil

CALCULATING APPLE PIE

by Melissa Keil

There's new graffiti scribbled on our porthole when I get back from my zero-G fencing class; neon writing, bright in the dark room, swirls across the window and blots out the starscape behind it. My sister loves decorating our pod with quotes and pretty art –vines and leaves curl all around the tiny space, in green NanoPaint that she's programmed to twinkle and sway.

We're allowed to do whatever we like inside our pods. It's mission command's way of maintaining the delusion that this ship is our 'home away from home.' But I know Arche's art is mostly to cheer me up. Today, in glowing emerald, my sister has written: The nitrogen in our DNA, the iron in our blood, the carbon in our apple pies, was made in collapsing stars. We are made of star stuff.

I flop into my bunk with a sigh. 'Good try, Arche,' I mutter. 'If we ever make it to our new home's borzy wasteland – I'll build a memorial to apple pies.'

After another day in middle-of-nowhere space, I'm tired and ready for a full-on glomp-out; but before I can get properly sulky, the pod lights flare, from evening gold to angry red, and the scream of the emergency siren tears through the ship.

It's the level-five alarm, the one where we're supposed to grab our evac kits and haul butt to the assembly points. It's the alarm that signals a catastrophic hull breach, an explosion in the ventilation chambers that means our air supply is toast. It's the We Are All Going to Die Horribly in the Cold Void of Space alarm.

And even though it has triggered approximately eighteen times since we set off on this voyage three-and-a-bit years ago, my heart seizes, then starts to gallop. Turns out, hurtling through space in a ship shaped like a beluga whale the size of a city block is dangerous, and kind of complicated.

The com panel on my wall pings, three pips and a bing. Masie's phoenix symbol swirls to life on the screen.

'Good evening, Kalyke!' chirps Masie in her singsong-y computer voice. 'Seems we've encountered a wee problem.'

Through the alarm shriek, shouting echoes on the other side of the pod door. A cavalry of heavy boots thunders down the corridor.

'Don't panic, Kal,' Masie says. 'I'm sure it's nothing to be concerned about!'

Which is pretty unhelpful since I am, in fact, panicking a lot.

The Migration Assistance and Shipboard Information Engine was designed as the ultimate low-key digital helper; normally, she's supposed to sound soothing and nondescript. But the computer's voice gave me the heebies when we first boarded, as bland as vanilla custard. So I dug into her operating code and tweaked her programming. Now, my Masie has an accent like my favourite BingSnap singer from back home in Colombo City, melodic and warm.

Mum laughed and said I'd programmed her to sound like me, which makes me seem a bit full of myself, even though it wasn't on purpose.

'Masie,' I yell through the ear-busting alarm. 'What is going on?!'

On the screen, Masie's phoenix wings still, her digital gaze turning outward. 'There seems to be a hiccup in the air filtration system,' she says, sounding mildly curious. 'Not to worry, Kal! I'm sure it will be resolved lickety split!' she adds cheerfully. 'You know the drill – make your way to location Sierra-E. Would you like some music for your travels?'

Masie's data banks contain pretty much all the music ever made. For some reason, she has developed a taste for an old-timey genre called 'folk rock'. She also likes to sing to me whenever I'm feeling particularly glompy.

I am not in the mood for music. I have shot to my feet, and though I know I should be hurrying to the emergency assembly point near the fitness centre, I am, instead, frozen in the centre of the pod. So when the door whizzes open and my sister flies into our room, she wallops straight into me and crash-tackles both of us to the floor.

'Jeez, Arche!' I yelp. 'Where's the fire?' And then I remember the screaming death-alarm, and the very real possibility that we might be about to asphyxiate in a space-fire, and my panic surges a dozen notches.

Arche jumps up and drags me to my feet. She grabs my arms, but whether it's to steady me or her, I couldn't say.

My normally calm, peaceable big sister looks totally flustered – the red emergency lights reflect in wild, wide eyes, her brown skin an awful shade of grey. She looks – well, a lot like me on a normal day in space.

'I think I've done something really borzy, Kal,' Arche yells over the alarm. She scrubs anxiously at the dark fuzz on her shaved head. 'Like really super ... bad.'

I blink, almost forgetting the red lights and screaming for a moment.

My sister does not do bad things. My sister is the gentlest soul in the system; happiest with her paints, or staring dreamily out our porthole and watching the stars go by, or weaving my long hair into thick braids. Unlike me, Arche loves everything, and complains about nothing. Also, Arche is a rule-follower; she's never even snuck into a grown-up VR dance club, which I know for a fact some of the older kids do.

I turned nine just before we set off. Arche was almost thirteen. There are two hundred and eighty-three other people on board the Panthalassa, the first Civilian Callisto Resettlement Wave – the very first community of migrants to call the embryonic moon outpost home. There are a few people my age, and a bunch of teenagers who Arche hangs out with in the VR cabins, and a heap of grown-ups and families who won a coveted place in the launch lottery. Three-and-a-bit years into the voyage, and everyone is still totally jazzed to be in space.

No one seems lost. And no one seems homesick.

Arche grabs my hands. I clutch hers back instinctively. 'Masie!' I yell, 'can you please lower the alarm? I know it's against protocol, but – we get the point!'

I swear, I hear Masie sigh. But then – praise all the gods – the alarm inside our pod fades.

I squeeze my sister's hands again. 'Okay, Arche – talk fast! What's happened? What ... did you do?'

Arche's whole face scrunches. 'I didn't think I did anything important! I was just ... fiddling. I was trying to help, for you, and I—'

Arche lets go of me. Then she whirls in a circle, sniffing the air like a puppy.

Arche is my favourite person in the solar system. Our parents are great, but kind of doofy (I mean, hello – they named their kids Arche and Kalyke, which says everything about their obsession with the Jovian missions). But even though my big sister has always dreamed of stars and adventures, she still gets me.

It's not that I'm not excited about this journey. It's just that going to something means leaving behind a bunch of other things. And all I can seem to feel is this blurry missing: all the people I will never see again, the places I'll never have a chance to go. I miss Colombo City, and Earth, with a ferociousness I didn't think possible. Arche adores the soft gold insides of the ship, but all that gold just makes me ache for the thousand shades of green in our Tree-Res community back home – no matter how much green Arche adds to our little pod.

My sister is currently still being mega doofy. 'Kal, I swear, I only made a tiny adjustment,' she squeals. 'Just a few lines of new code—' Arche sniffs again, and her dark skin goes even greyer. 'Can you smell that?' she whispers.

For three-and-a-bit Earth years, Arche and I have shared a room the size of our sonic shower back home, with our parents in a pod across the hall. Our room typically smells like thermo-dried clothing, and Arche's feet.

I raise my head and sniff cautiously.

The air does smell weird. But it also ... tastes weird? It tastes thick, like the ventilation system has kicked a bunch of extra aroma compounds into the room. It tastes like—

Arche fidgets fretfully with the sleeves of her dress.

'Arche?' I gasp. 'What have you done?'

'Oh my!' Masie's wings quiver, and she chirps, and bings, and chirps again. I think it's her version of a laugh. 'I believe we're experiencing a particulate separation error in the air filtration system, caused by an overload in the D-Fac mainframe. Wowzingers! A snafu in the Dining Facility? That's gonna to be a head-scratcher up on command deck.'

I take a big breath and suck in another mouthful of air. It's changing, waves of weirdness wafting through the vents. It tastes like—

'Tomato soup. And is that ...' I stick my tongue out again, the air shifting from garlicky, salty warmth to tangy sour-sweet. 'It is!' I yell. 'It's lemon cheesecake!'

Arche buries her face in her hands. 'I'm sorry, Kal! You've just been so sad, and I wanted to do something – it was meant to be a surprise! But you know I'm not great at complicated programming! I'm kind of jammy with my NanoPaints, but I suck at everything else—'

'Arche – say that again? You did what?'

'I added some code to the MFMT system,' Arche says miserably. 'We've always said that it's missing a whole bunch of recipes, that they didn't account for some of the special things people might crave. I thought I'd figured out how to add just one thing. For you ...'

'Oh,' I say. Then the full meaning of what she is saying reaches the comprehending part of my brain. 'Oh no. Arche. You messed with the food fabricator code?'

The borziest thing of all about being in space? None of our food is real. It's all engineered, state-of-the-art Molecular Fabrication and Modulation Technology, a fusion of edible 3D-printed atoms overlaid with a taste profile.

It's ... fine, I guess. It's nutritious. And it solved a few big problems of preserving and transporting enough food to keep hundreds of humans alive in space, cos even though they've been experimenting with terrafarming on Callisto, so far, they've only managed to grow, like, kale, and a few crops of sad-looking beans.

MFMT food almost tastes like what it's supposed to. Most people will say that, if you didn't know your dinner was fake, you wouldn't be able to tell the difference.

But I can tell the difference. A collection of atoms, no matter how whizzy the programming, is still just atoms. Eggplant curry just doesn't taste the same without our neighbour's terrible singing as they stirred it at their stove; the earthy-sweet crunch of spices from Dad's mortar-and-pestle can't be replicated by an algorithm. Our food is fine, but there are a whole bunch of flavours that they just didn't think to include. I know I was being a brat, but the first time I saw a salad sandwich materialise out of thin air inside a silica food chamber, I burst into tears. Arche tried to calm me down by stroking my hair and requesting wattalapam, but the machine didn't have the code for that, just producing a sad puff of molecules that, for a moment, made the air smell like cardamom and nutmeg.

'What were you trying to make?' I manage to ask.

Arche sits heavily on my bunk. 'Chicken curry. A proper one, like Dad used to make on weekends. Remember? The way it made the whole house smell yummy and coconutty, and how Dad always made a little super-spicy pot for Theo next door? The doofy runny stuff the fabricator spits out isn't the same – even I know that.'

Masie's wings vibrate merrily. 'I believe Arche has made what is known as a gastronomic gaffe. A food fail. A snaccident. There is an amusing incident on file from the mid twenty-tens, a television program called Master Chef—'

'Masie!' Arche yelps. 'Save the story for later, and tell us how we fix it! Is the ship in danger? And more importantly – how do we fix it?'

Masie chirps. 'I don't believe we are in danger. Probably not. Oxygen levels remain steady, by the look of things?'

Arche's saucer eyes widen even more. 'Don't you know for sure?'

'Weeeeell ...' Masie's wings shrug. 'For some reason, they thought it was a bad idea to give me access to the ship's core functionality. I hear the bots that manage life support are just swell though.'

'Okay, okay! Everyone, calm down.' I take a deep breath, getting a lungful of pavlova and spaghetti bolognaise. 'We can fix this. We just need to log into the D-Fac mainframe, and undo whatever Arche did.'

'Easy-peasy,' Masie says. 'How do we do that, Kal?'

I ignore the probability that at any moment now, ship security – or worse, our parents – are going to realise that Arche and I are not where we're supposed to be. And I can't even consider the other nightmare scenario – that my sister has done permanent damage to our primary food supply, dooming almost three hundred people to starve to death in this whale-shaped deep-space tin can.

Instead, I force my brain to focus, unscrambling everything I know about the ship's systems, and the ways they are interlinked.

I drop down in front of Masie and push the wall beneath her screen. A gold panel, overlaid with a twinkly sketch of a fern, opens. Beneath it is an emergency control console and a keyboard.

Masie bips uncertainly. 'You know it's against my protocols to spy, Kal. But you are going to be late for the evac headcount. And I am supposed to alert command if any passengers are putting themselves at risk.'

'Masie,' I say, tapping at the keyboard, 'Can't you just ... look the other way for a sec?'

'Excellent idea!' Masie says. 'Can't report on what I can't see!' Her phoenix flickers, then flips around. A plumy tail flaps in our direction. She also starts to hum, loudly.

I sit cross-legged in front of the keyboard, the ship whirring through my body, the alarm howling in the distance, the taste of mint milkshake and pepperoni pizza on my tongue.

Arche kneels beside me. 'Kal, we can't log into the ship's systems from our bedroom. Can we?'

I grimace. 'Um, normally, no. We're just supposed have access to school stuff. Music and old BingSnap videos. Games ...'

Arche nudges my arm. 'But?'

'Well, I might have ... installed a remote tool that modifies our access? And it might've let me ... hack into all of the ships operating systems?'

Arche's jaw drops. I tell my sister pretty much everything, but not even she knows that I've been messing around with this.

'It's nothing dangerous, I promise!' I add quickly. 'Mostly I've just been ... keeping an eye on things. Monitoring the navigation deck and making sure they're not piloting us into a comet or something.'

The mission command grown-ups seem to think that the rest of us should be happy just hunkering down with entertainment, and not sweating the details of the journey. It's doofy, I know, but information – learning how the Panthalassa functions, and keeping up-to-date on how she's running – is just about the only thing that helps me feel less like a barnacle. It's the only thing that stops me feeling so powerless.

Arche shakes her head. 'Kalyke, you and I are going to have a proper talk later. But – can you fix this?' She wafts a hand through the air, which now tastes like Singapore noodles covered in clam chowder. 'Kal! What if I've actually broken something for good? Dad and Amma are going to flip out. I'm in so much trouble!'

'No, you're not,' I say, typing furiously. 'As long as we can get into the fabricator system before anyone notices we're missing. I can fix it, Arche,' I say with as much confidence as I can muster. 'We just need to think about how the system should be working, then find the place where your code is making it do something else.'

I'm pretty jammy at all kinds of programming, but it's never actually occurred to me to mess with food production, no matter how badly I've been longing for a taste of home. Not even I would be that reckless.

I glance sideways at my sister's freaked-out face. And I turn back to the console and straighten my spine.

I have to fix this. And not just to save Arche. I might be all that stands between the two hundred and eighty-three souls on board the Panthalassa and a slow, agonising famine, a nightmarish, drawn-out starvation disaster—

'Oh – okay! Here it is!' I say triumphantly, almost tripping headfirst into the D-Fac mainframe and through to the fabricator's data-access layer.

Arche squints at the screen. 'Really? Just like that?'

Masie chirps. 'Yeah, it's not super protected, kids. Obviously, mission command didn't think the burger-and-fries dispenser was a top security priority.'

My hands freeze on the keys. I could search for Arche's errant code, but tracking it down might take ages. Meanwhile, the alarm still screams in the background; and I half expect our parents to start hammering on our pod door, cos by now they must surely have made their way from their swing dance class; and the ship technicians have got to be honing in on the problem, which my sister has probably left digital fingerprints all over; and who knows what lasting harm the overload is causing to the D-Fac hardware; and Arche looks like she's about to puke all over the gleaming gold floor.

I think for a moment. Then I fire off a few hasty but precise commands, and reset all of the Dining Facility's systems to last week's emergency backup.

The alarm dies.

The pod lights return to evening gold.

I run my eyes anxiously over the MFMT interface, but there are no error codes or bugs that I can see. The food production system looks like it's ... just fine.

Masie peers down at us, the face of her phoenix squished against the screen. 'Well. That was exciting. Nice one, Kal!'

Arche and I scoot away from the console. We both seem to be holding our breath, but there's no sudden pounding on our door, no security alert or furious Amma-face on Masie's com screen.

I collapse against my sister. And even though my heart is still racing, I start to laugh.

'I can't believe you did that, Arche,' I say through snorts. 'You, who've never even tried the hack that turns oatmeal into breakfast chocolate!'

Beside me, Arche she starts to giggle as well. 'How was I supposed to know that state-of-the-art tech designed for deep space would be so complicated?' She wipes a shaky hand over her eyes. 'But, oh. I really did want that chicken curry, Kal. You ... know you're not the only one who's missing things. Right?'

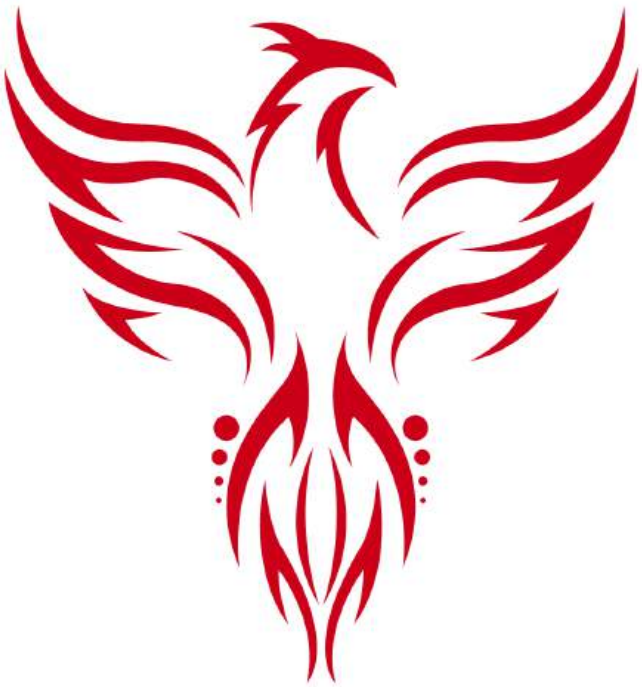
I lean my head against Arche's shoulder. Around us, her jungle-green artwork twinkles and sways, a tiny reminder of the home that's receding ever further behind us.

‘Thank you for trying, Arche. Maybe we can give it another go sometime? Proper chicken curry can’t be that hard to code. We just might need to do some research first.’

I sit side by side with my sister, our backs against the porthole, the neon graffiti and the endless expanse of stars, the taste of syrupy pancakes fading on our tongues.

Then my tummy growls, reminding me that it’s probably time to venture outside our little room.

‘Hey, Arche? Do you want to get dinner? I’m suddenly really hungry.’



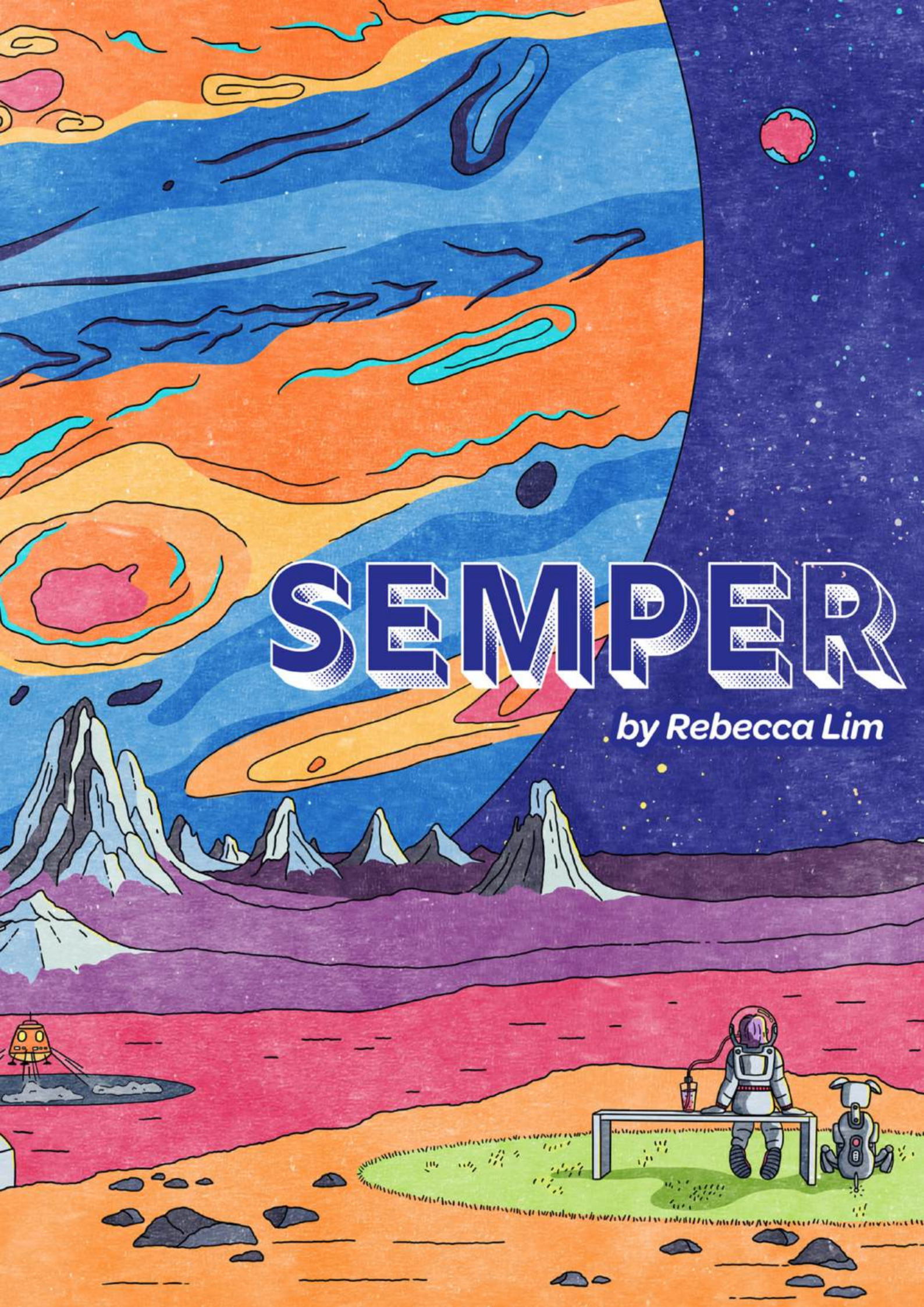
Calculating Apple Pie is the second story in The Callistan Cycle as part of Imagining The Future.

Calculating Apple Pie by Melissa Keil
Story Editor Kate Whitfield
Artwork by Cassandre Collins

Imagining The Future is a program from Future You.

See you in the future!

FUTURE you


SEMPER
by Rebecca Lim

SEMPER

by Rebecca Lim

Semper nudged Shang with its head, whined.

Just sit,' Shang hissed.

Semper wriggled in under Shang's elbow. Shang, trying to listen to the commander, shook Semper off, growling deeply to show who was boss.
Semper lay down and rolled over, still whining, its feet pointed straight up in the air. Shang went hot under her spacesuit, hoping no one else had noticed.

She had the worst robo on the entire base.

When the base's computer, Masie, had assigned robos, Shang had hoped for a toothpick, one of the long, tall ones that didn't take up much space, and had saved countless lives already, or a Noid, an AMR that looked almost human. What she'd been assigned, like most of the younger Corps on the base, was a robo that looked vaguely like an animal.

One person had a smooth silver rabbit, another a metal snake that they wore draped around their shoulders like a scarf. There were a whole bunch of cats that could leap metres into the air, with incredible vision and prehensile tails. There was even a robo pig, built especially for finding things. Some had bird-like robos that sat on the Corp's shoulder. Birbos had unbelievably strong feet and diamond-hard beaks – great for missions – and they could fly. Shang would have liked one of those because they could take care of themselves.

But she'd been assigned something that looked like a giant terrier puppy. A big useless Drobo that was smooth and silver. And needy. It always wanted to play, like a real dog did. Not a single pilot, engineer, scientist and mission specialist on the base had time to play fetch, not really. But when someone came across Semper in a hallway, cargo bay or airlock, Semper wanted to do just that. Keys, clipboards, grobags – it didn't matter what it was – the person would have to throw it and Semper would bound away and bring it back to them with its jaws. The one good thing about Semper, Shang thought, was that it didn't drool like Earth dogs did.

Semper made everyone smile, except Shang.

Shang couldn't understand why she'd been paired with Semper. It couldn't fly and it couldn't leap high or far like the Crobos, Birbos or even the Rabbo could.

When Semper had loped towards her, its heavy metal feet thudding on the silica tiles of cargo bay N-11, Shang's heart had sunk down into her gravity-enhancing shoes. Everyone on board who already had a robo had whispered to those finally getting their own that Masie was actually magic – she could see into your soul and work out the perfect companion for you. But when Shang had seen Semper, something inside her had tightened in instant rejection.

Shang glanced around at the dozens of assembled Corps about to deploy. Some were still just wearing their inner thermals and the 'lower torso' of their spacesuit, others were fully suited up.

Through the nearest viewport, the entire mission had uninterrupted views of the ancient, heavily cratered surface of Callisto, one of Jupiter's moons. Years before, Callisto had been selected as the base for exploring the four largest Jovian moons – Io, Ganymede, Europa and Callisto itself – because it was the most stable, with the lowest radiation, a thin exosphere of carbon dioxide, and atmospheric hydrogen and oxygen that the base could harvest. Two generations had already been born on Callisto before Shang had arrived from Earth, wanting to see the galaxy.

Callisto was a dry chunk of ice and rock, with almost zero volcanic activity and loaded with valuable silicates. Because it sat outside Jupiter's active radiation belt, the base had flourished. Around the mess of interconnected living modules were extensive terrafarms, which supplied Callisto's people with fresh food. Someone had even built a small 'park' a little distance from the base, with a bright green, fake grass surface and a steel bench set into it that remained shiny in the dry atmosphere. Above it all, Jupiter hung so large and low that the sky never seemed dark.

Of course, if you wanted to sit out in the park, you needed to wear a full spacesuit, including a helmet. So people didn't go there very often, or for long, because it was negative 139 degrees Celsius outside.

Shang stared out at Jupiter, hanging overhead like their own cold sun. Every time she caught sight of it through one of the viewports, she'd get goosebumps. She was actually here. The Hohmann transfer from Earth had taken almost six years, most of which she'd spent sleeping. She was eager to get onto Europa, the moon she'd been assigned to explore for resources and critical minerals.

Shang had less than one Earth day on Europa to get her samples. One Europa day equalled three and a half Earth days, and she had to be back on the transport at the start of Earth day two because it was leaving, with or without them, well before Europa completed one orbit around Jupiter. Even with their spacesuits, and the shielding on their All-Terrains, many of them were likely to be sick afterwards because Europa's surface radiation was over 1,800 times greater than Earth's.

She'd sacrificed a lot to be here.

Everything, in fact.

"So, in conclusion,' said Commander Chandrayaan, her dark gaze sweeping across their faces, 'take off is now, because Ganymede, Europa and Io are within 60 degrees of each other. Those going to Ganymede are facing two weeks' travel, those heading to Europa about four days' flight time. Only shield robos for Io,' she added, 'because it's too close to Jupiter for safety. Minimum delta-v expenditure, and under no circumstances do you leave your All-Terrain, you know the drill...'

The mission cohort rose, some fastening helmets, others pulling on the hard outer shell that protected the flexible inner garments that kept them cool or warm, hydrated and fed, and removed waste. The extravehicular mobility units, or EMUs, had come a long way since the early days. They were no longer orange, but they were still heavy because of all the lifesaving tech.

'You're new, right?' her captain said. 'Where's your robo?' Shang looked around wildly. Everyone else had theirs and was ready to board.

The captain rolled her eyes inside her helmet. 'You've got one Earth hour, Corp to find it, or we're leaving, and you'll deploy the next time we decide to run a mission – which could be next Earth year. It's a long time to be cooling your heels at base, so find it.'

Shang went cold. Checking her wrist comm, which set out both Earth and Jovian time, she knew she had to hurry. The base was huge – Semper could be anywhere. This was supposed to be her first off-moon exploration since arriving. She'd been in training since she'd reached Callisto, months ago. Furious, Shang ran through base, pinging Semper on her comm.

Semper didn't come. Wasn't it programmed to obey?

Finally, although Shang had been resisting it, she switched on Find my Robo. Immediately, a voice said, 'The park.'

'Oooooh,' Shang growled, jamming her visor down and fastening the seals around her neck and waist. She burst out of the base through a blast door, feeling her gravity-enhancing boots kick in. She ran past a whole series of brightly lit terrafarms with ground-eating strides until she reached the bench, framed beneath luminous Jupiter.

Semper was sitting beside it, just like Shang's dog on Earth, Maxima, used to do at their favourite park. Its head was even tilted to one side, like Maxima's did when she listened. Shang imagined her now, a small, sandy Scottish terrier with alert eyes and ears, bushy eyebrows and whiskers, still waiting for her, patiently.

Inside her helmet, Shang's eyes unexpectedly welled with tears that the complex life support system in her suit quickly detected and removed.

Semper was the opposite of Maxima – a big, soulless, disobedient troublemaker.

'What are you doing out here?' Shang cried. 'We have to leave.'

She almost fell over backwards when Semper replied, 'I'm forcing you to stop and smell the coffee. Your stress levels have been off the charts for days!'

'This isn't helping!' Shang replied, trying to yank Semper upright. Even with her extra-grip gloves on, she couldn't make Semper yield.

Why aren't you behaving like a dog?' Shang snarled.

'You weren't responding to dog mode,' Semper replied. 'Whenever I played fetch your stress levels rocketed. Whining and rolling elicited the same reaction. I have ceased dog mode, for now.'

'We need to go!' Shang snapped, still trying to yank Semper upright. 'I can't leave Callisto without you. Come on.'

'Why don't you like me?' Semper said, so quietly that Shang straightened in surprise. 'I like you,' it continued. 'I would do anything for you. As soon as I saw you, I thought that.'

Semper tilted its head again, just like Maxima would have. Shang took a sudden breath so deep and sharp that it hurt.

She sank to the bench and looked up. The view was immense – the strangest, most beautiful view anyone would ever see. Because Callisto was locked to Jupiter in a certain way, they saw the same side of the gas giant every day. But it never looked the same, because cloudy bands of white, brown and yellow endlessly boiled across the surface, Jupiter's red eye constantly changing. In a bustling base filled with constant noise, the park was a good place for Shang to escape to. But she'd never taken Semper here before.

'I don't hate you,' she murmured.

'You did,' Semper interrupted, always truthful. 'You just hate me less now.'

'You're imagining things,' Shang muttered. 'I just wanted...'

Something different,' Semper said, standing and coming around to face her. So tall that it reached the middle of Shang's chest.

'I didn't want a dog,' Shang whispered. 'I had to leave Maxima behind. I don't even know if she's still alive. I left Earth over six years ago. She was my only family.'

Shang's normally calm voice sounded strange with grief.

'I don't look like Maxima,' Semper murmured, 'because I'm not supposed to take her place. But I will take care of you. That's my overriding duty. I'm to keep you safe and functional.'

I don't need your help,' Shang muttered, standing and looking down at the vague suggestion of a puppy. 'Plus, you're just a collection of metallic elements and wire. Let's go, we're late.

The four days to Europa aboard the transport, Taiko 9, seemed to take longer to the twenty-four astronauts aboard. Shang thought about the other ship hurtling towards Ganymede, and was grateful for drawing Europa. It had way more radiation, but there was less time to worry that she wouldn't make it home.

Everyone on board was quiet, even the normally talkative robos.

They kept to their seats until it was time, each day, for them to exercise in the All-Terrain bay. Giant humanoid exoskeletons were secured along all four sides. Each had a blank two-way screen where the face would be, and powerful, extendable arms with a gripping claw on the left, and a drill on the right. While on Europa, every Corps would be encased in an exoskeleton, which was capable of lifting tonnes of raw material and could also take samples for analysis. Each exoskeleton was heavy, crafted out of lead, tungsten and titanium to shield the person inside, and the complicated electronics hub and fuel cell, from the elements battering Europa's surface.

They were mobile radiation vaults. If they failed on the moon's surface, the wearer would die within hours. Each Corp's robo was there to help keep the path clear, suggest routes, troubleshoot and keep their astronaut alive. Exoskeletons had a habit of toppling, or getting buried, so the robos were there to steer their companions away from trouble.

As they finished up their exercise session on day four, the onboard Masie said, Buckle in. T-minus 10 minutes and counting.

Every Corps scrambled for an exoskeleton, climbing inside the portal on the machine's 'chest', which closed as soon as the safety harness was properly fastened, sealing tightly. Snug in her metal armour, Shang could make out the rigid roll cage that would cushion the impact of landing. Light-headed with fear, she wondered whether Semper felt afraid.

Abruptly, the floor fell away. Shang screamed as the exoskeletons were sucked out, one by one, into an atmosphere approaching negative 160 degrees Celsius, charged with a deadly plasma of freely flowing ions and electrons. Nothing alive on the surface of Europa witnessed the hail of robos and exoskeletons falling out of the open hold of Taiko 9.

*

They'd targeted a landing area on a low mountain range surrounded by a vast wasteland, or chaos terrain, that stretched for kilometres in every direction.

As the exoskeletons and robos stood upright on the ice-covered mantle, they saw within the chaos terrain a crazed patchwork of cracks, parallel lines and ridges, ice blocks and smooth fields of sheet ice interspersed with lenticulae: areas resembling darker-coloured freckles. On one edge of the chaos terrain was a huge field of tall, razor-sharp, icy spikes that Shang knew were called penitentes.

The range they stood on shook beneath them. Despite the howling, freezing winds outside, each person could hear loud grinding noises, as if giant plates were moving beneath Europa's surface.

The range they stood on shook beneath them. Despite the howling, freezing winds outside, each person could hear loud grinding noises, as if giant plates were moving beneath Europa's surface.

No one spoke, even though they were connected via comms. Forty-eight figures climbed carefully down the mountainside to seek out mineral samples in the chaos terrain below. At the base, they spread out in pairs, moving in awe between vast, tumbled blocks of ice, and deep parallel scores in the icy surface, like frozen train tracks.

Semper's voice sounded inside Shang's helmet. 'Where to, Boss?' said the not-dog.

Shang swivelled, her exoskeleton responding. She scanned the cracked terrain through her visor.

'Let's head towards that field of penitentes,' Shang said, 'if they're anything like the ones on Earth, there may be "red" ice patches in them, indicating life – and remember your programming, Semper.' Shang wanted to be the first person to find life, or actual evidence of Europa's rumoured vast, sub-surface sea. No one had yet, so Shang had spent most of the flight fine-tuning Semper's sensors to pick up the rumoured sub-surface volcanic activity. Where there was heat or movement, there would be water.

Shang's exoskeleton began leaping across the chaos terrain – covering enormous distances in gliding steps. Semper ran alongside, calling out when particular patches looked too soft so that Shang, inside her suit, veered around, never quite overbalancing.

Drawing closer, the penitentes looked like raised swords. They stood almost fifteen metres, carved to sharp points by the atmosphere on Europa. Walking among them, looking up through their points to the cold sky above, the eerie underside of Jupiter, Shang had never seen anything so alien.

Seeing a small patch of colour within the penitentes, she set her drill and began taking samples, working her way across the field, storing them in her exoskeleton as she worked. Semper moved always a little ahead, its sensors constantly gauging gravitational pressure and temperature, the shifting concentrations of atmospheric oxygen and hydrogen, scouting for evidence of heat or water, as Shang had programmed it to do.

Sensors suddenly shrieking, Semper didn't have time to warn Shang as the ground beneath her suddenly rose into the air so quickly that the heavy exoskeleton fell backwards and could not rise, pinned to the rising ridge by its own weight.

Around the fallen exoskeleton, a plume of water – water! – one hundred kilometres high, suddenly jetted upwards, another quickly following.

Far below, on a broken ridge of ice, Semper barked in warning. A lenticula was forming beneath the icy plate that Shang's exoskeleton lay on.

'There's silicate magma under the ice crust!' Semper warned. 'Volcanoes – big ones!'

Inside her exoskeleton, as she rode the rising ridge of ice and rock into the sky, Shang thought, I did it. We did it. We found evidence of water.

She thought about Maxima, about how much she missed her. Even about Semper, its warning barks sounding inside Shang's helmet. Her life support system, the lighting inside the exoskeleton, flickered for a moment, resumed. Shang realised she'd been holding her breath. All around her, there were terrible grinding sounds.

Abruptly, all movement stopped.

Then the ridge she was lying on began to tilt, wildly. Shang, her exoskeleton beginning to slide down the steep slope that had suddenly formed, screamed again as she hurtled back towards the field of penitentes at a terrifying speed.

She closed her eyes, still screaming.

The exoskeleton landed with a sound like a bomb going off.

It bounced once, fell again onto its back.

Semper's featureless silver face suddenly loomed in her visor and Shang was hit by a chorus of voices – robo and human – asking her to confirm location, whether she was alive.

'I'm alive,' she shouted into the comms channel, 'but I'm in trouble. Don't come after me, any of you. It's too active, too dangerous. Semper's here.'

Shang turned off the clamouring voices. Before Semper even confirmed it, she knew.

'You've destroyed the mechanics and joints in your suit,' Semper said matter-of-factly. 'You're not going to be able to walk back to the drop point. And you need to get up high for your suit to automatically connect you to the Taiko 9. The tractor beam can't reach you down here.'

Still winded by her incredible fall, Shang thought about how people had told her that being an astronaut wasn't a job for someone who'd never been the best at maths. She was glad she'd ignored them. She closed her eyes, not regretting the decision to come all this way at all. Her only regret was leaving Maxima behind.

All the space missions they'd sent here over the years – Voyager in the 1970s, Galileo in the 1990s, the Jupiter Icy Moons Explorer in 2023 and the Europa Clipper in 2024 – none of them had seen what she'd seen. There was liquid water under the surface, and powerful volcanoes.

But she'd never be able to tell anyone herself, because her exoskeleton was broken. It would never stand again.

Semper,' Shang whispered. 'Take the samples, get to the ridge, wait with the others for the tractor beam.'

'Nope,' said Semper firmly. 'I'm staying with you.'

'Then you'll die here, like I will,' Shang said desperately. 'You know I can't leave the suit. I wouldn't survive for two seconds outside it.'

'Set off your beacon,' Semper urged. 'At least the Taiko 9 will know where you are.'

Shang did so, the sonic whump filling her helmet. 'But it's useless,' she mumbled. 'They can't fetch me from down here.'

'Fetch!' said Semper and Shang suddenly, at the same time, on exactly the same wavelength.

'I'm going to throw out the arm with the claw,' Shang said through chattering teeth, shock setting in.

'No, both arms,' Semper replied.

'And when you sense volcanic activity, something really big, like what just happened,' Shang added, 'you—'

'Fetch,' Semper replied.

'And bury,' Shang said fiercely. 'Bury, like a dog would bury a bone.'

'Dog mode, engaged,' Semper replied, as Shang threw out the tough, cabled, extendable arms of her exoskeleton like fishing line.

The moment Semper sensed a strong eruption building below them, it fetched first the claw, burying it deep in the ice, quickly followed by the drill.

'Grip fast!' Semper yelled inside Shang's helmet.

Then the ground beneath the buried 'hands' of the exoskeleton rose suddenly, like an angry fist, punching towards the sky. Dragging Shang with them.

'Semper!' Shang shrieked, but Semper had already been left far below. Turning her head weakly, the exoskeleton's head rolling slowly right, Shang thought she saw the red glow of silicate magma before the ice field below closed over again, frozen solid in an instant.

Of Semper, there was no sign.

Up above, the tractor beam caught the prone human figure strapped to the rising plate of ice and locked on, drawing it upwards towards the Taiko 9.

*

Shang sat on the bench, staring up at the swirling underbelly of Jupiter, vast overhead.

She'd come to the park every day after being discharged from the MedWing.

She'd been lucky. It was her pre-programming, and Semper's quick thinking, that had allowed her to hook onto the ice plate, projected upwards with so much force by the volcanoes beneath that the tractor beam had latched on. She'd been the first to arrive back onboard, her exoskeleton shattered, although the samples she'd taken were safe. Shang had single-handedly proven that there was liquid water under Europa's icy crust, a sea filled with underwater volcanoes. They would send more astronauts soon.

She'd done a great thing, they all said. But Semper was gone. It had done what it had said it would do – kept her safe and functional.

The bitter cold began to seep into her spacesuit. Limping, she made her way back to base. As she sealed the blast door, a voice behind her said, 'Fetch?'

Feeling a bolt of pure joy, Shang spun, seeing a smooth, featureless suggestion of a terrier, standing across the cargo bay.

'Semper?' She raised her visor in wonder, watching as it thudded towards her. She wondered if it was the same AI, just in a different body. Masie could do that.

As if Semper had read her mind, it said, 'I am, and will always be, Semper.'

Semper nudged Shang's knee. She knelt and gave Semper the kind of hug that used to make Maxima squirm.

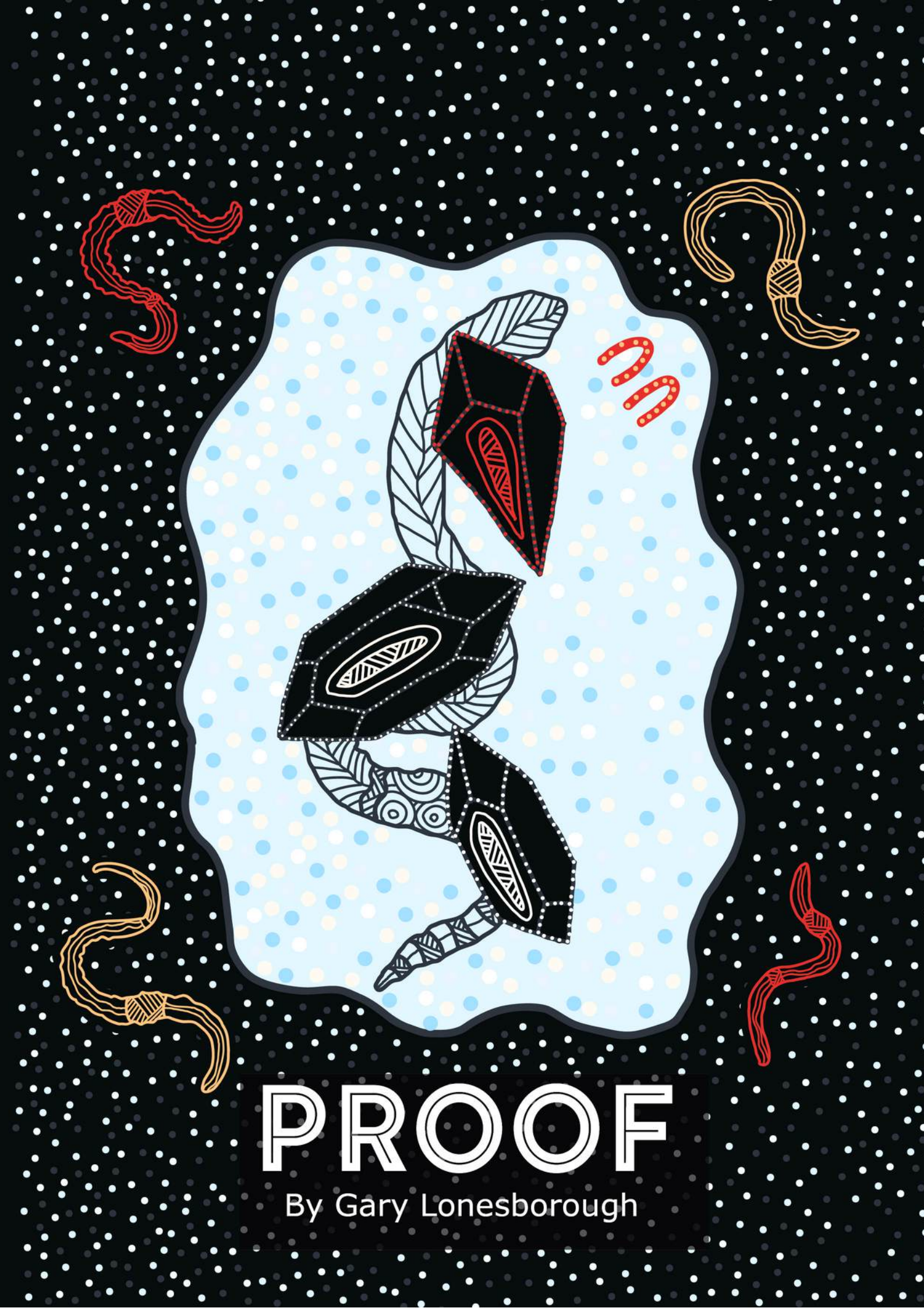
Semper is the third story in The Callistan Cycle as part of Imagining The Future.

Semper by Rebecca Lim
Story Editor Kate Whitfield
Artwork by Cassandre Collins

Imagining The Future is a program from Future You.

See you in the future!

FUTURE you



PROOF

By Gary Lonesborough

PROOF

by Gary Lonesborough

There's a view of Jupiter out of the skylight. It's clear enough to see the clouds shifting across its surface. My mathematics classroom is at half capacity, and the only person in the front row coughs three times before raising his hand.

'Yes?' Miss Mac asks.

'Can I go to medical bay, please?' the boy asks. Miss Mac sighs then nods her head. The boy stumbles out the door, his hand pressed against his chest. I haven't managed to remember his name yet and it's three days into the first week of high school. So many people have been getting sick lately, including my friend, Alisha. There must be a flu going around the outpost. I kind of wish I was sick too, so I could get out of this place.

The bell sounds for lunch and I follow the others out of the classroom, through the corridor and onto the playground, which is covered in plastic grass with a tall replica eucalyptus tree at the centre. The artificial sun burns orange and its warmth sneaks through the glass.

Across the playground, the teacher patrols, surveying everyone. Some kids kick a round ball on the grass. Other groups of friends and couples hang out on the seats and tables. Some laugh and hold their stomachs. Some whisper into each other's ears. Some are pointing upward towards Jupiter. The gassy surface moves like shifting sand of many different colours, blown by the wind.

I fasten the straps of my backpack on my shoulders and head to the end of the playground. I don't want to be here. I push the gate open and walk out of the school.

The road I walk along is paved with recycled materials that are cracked and fading. They usually resurface it every year, but I haven't seen them working on it in ages. I pass by the convenience store, where a sign out the front declares they are having a special on roast beef puree. A waste truck drives by, its gravity wheels make clunking sounds. It booms along the road, headed outside the base to the waste recycling centre beyond the outer fringes. There's no one walking around. Some of the shops are closed. Must be because of the sickness.

I pass the Earth Museum. I wonder what it would be like to be on Earth, and go to school there. Maybe it would be easier to make friends. With that many people, there must be some who are more like me. I glance up at the sky. Beyond the dark-blue hue of the dome, the stars are shining. One of those shining stars could be Earth for all I know.

My house is on the outskirts of town. The dome's edge sits beyond the artificial bush behind our backyard. My house is rectangular, with two square windows at the side of the dining room and the side of the living room.

I head to the front door and let myself inside. In the living room is Masie, my older sister Rachel's android. She's metal and human-shaped, a tad taller than me. She has a red sensor at the tip of her nose for scanning.

'Welcome home, Tanner,' Masie says. 'You're back earlier than expected.'
'School finished early,' I say, throwing my backpack to the floor. I head over to the couch and surrender to the cushions. 'TV on.'

The news is playing on the feed, streamed from the space station near Mars.
'There have been no notifications of school finishing early today,' Masie says. 'Were you provided with the reason for the premature closure?'

'No,' I reply. Masie is always questioning everything, but the thought hasn't even occurred to her that I might have lied. She's an older model, due for an upgrade, but Rachel won't trade her in.

The two women on the news are boring. Their voices are monotonous and they don't blink their eyes, which is weird. Maybe I'm just not noticing their eyes blinking.

‘Our congratulations to Shyler Lee in the Mars outpost, who has just celebrated her hundredth-and-fiftieth birthday,’ the newsreader says. A picture of Shyler Lee comes onto the screen. There are plenty of wrinkles on her face, but her smile is wide and warm. I can’t imagine being that old. I’m only fifteen now. I can’t imagine having that many years of memories. I can’t imagine having that many wrinkles on my face. I can’t imagine my face broadcast across the solar system with an unblinking newsreader congratulating me on turning one hundred and fifty years old.

The back door opens and I hear boots stomping towards the living room.

‘Tanner? Why aren’t you at school?’ It’s the voice of my older sister Rachel.

‘School has finished early today for an unspecified reason,’ Masie says.

I glance over my shoulder to see Rachel standing in the doorway. Her black hair is tied back and she’s got her travelling suit on, except for the helmet.

‘Why are you *really* home early?’ she asks.

I sigh. I can lie to Masie like a reflex, but I can’t lie to Rachel.

‘My friend is sick,’ I say. ‘She’s been sick all week and no one else there likes me. I didn’t want to be there anymore.’

‘Tanner,’ Rachel sighs. She walks over to me and sits on the armrest of our couch. ‘You shouldn’t skip school. School’s important.’

‘Where are you going?’ I ask.

‘Oh,’ she says, looking down at her travel suit. ‘I’m heading out to the research centre, to the filtration system. I have a hunch about something, but I need to test the water first.’

‘Maybe I could come. It would be good field learning for me,’ I say. She sees me looking over her suit. I widen my eyes and smile. Whatever she’s doing will be more interesting than the news.

‘Get your suit, then,’ Rachel says. I jump from the couch and run outside to the shed. Mum and Dad never let me leave the base. My travel suit is pretty much sitting in the backyard growing old.

I take my suit from the hooks. I climb into the bottom half and shuffle my feet into the boots. I pull the top half over my body and zip the top and the bottom together at my waist. I take my helmet from its hook and race back inside, where Rachel and Masie are waiting by the front door.

‘Don’t rush off anywhere without me,’ Rachel says. ‘And do whatever I say. Got it?’

‘Yesssss.’

I follow Rachel and Masie to the garage and we climb into her Explorer. The big gravity wheels sound like rumbling rocks as we head along the road through town, past school and to the outer gates. Rachel shows her pass to the guard. The wall comes down behind us and we put on our helmets. The gate opens in front of us, raising above our heads.

‘Adjusting temperature,’ the AI in my travel suit says. It’s a robotic voice, unlike Masie’s. Her voice has more personality. She’s not just reading lines – I swear she actually thinks before she speaks. My suit adjusts my temperature as small icy marks appear on the windows of the Explorer.

The sky looks different outside the outpost. It’s darker and deeper, less filtered when not covered by the dome.

‘I haven’t been out of the base for so long,’ I say. I gaze out the window as we drive around one of the deepest craters on Callisto’s surface. The light doesn’t reach into the very centre and all I see is shadow.

We follow the road until we reach the borders of the Valhalla crater. At the centre of the crater is the research centre. It’s a big square building that looks like a silver box on the outside. Beside the garage are big trucks filled with filtered and purified water. We follow the icy road down Valhalla.

I’m first out of the Explorer. My body is lighter outside the outpost and each step feels like a little jump on the rocky surface.

Rachel and Masie get out and I follow them to the front door. My breath is warm inside the helmet. I can feel the cold of outside threatening to break through my suit.

Rachel stops at the control panel and the red light comes on. ‘Rachel Lantly,’ she says. The red light turns blue.

‘Identity verified,’ the robotic voice from the control panel says. The door opens and we step into the pressure room. The door closes behind us and oxygen floods the room. The beep signals to us that it’s safe to take our helmets off. The air is warm and thick inside the research centre. It feels like I’ve got a warm blanket around my body.

‘Come on, we need to check the water,’ Rachel says. I follow her and Masie to a door with *Filtration* written on it. Inside, a machine churns and chugs in the centre of the big room, which is more like a warehouse.

Rachel presses a button and the machine slows to a silent stop. She takes a test tube and a syringe from a drawer and opens a small hose on the machine.

‘This is where the water passes through before it begins the filtration cycle,’ she says.

‘Your grandparents were the pioneers,’ Masie says. ‘When the population began to boom on Callisto, so did the need for a more sophisticated water purification system. Your grandparents led the team who created this incredible machine.’

‘Yeah, I’ve heard this story before,’ I sigh. I know my grandparents were smart. I know my parents are smart. I know my sister is smart, and I know I’m not.

Rachel uses the syringe to draw out some of the water, which she then deposits into the test tube. She takes a dipstick from the desk and places it into the test tube.

‘Have you been noticing there’s a sickness going around?’ Rachel asks me. ‘Yeah. Lots of people at school are off sick.’

‘I think it’s got to do with the water,’ Rachel says. ‘The filters should be purifying the water as it’s pumped up from beneath the surface, but something’s *off*.’

I shake my head. ‘Maybe the moon is melting.’

Rachel glances up at me and then back to the results.

‘My biggest worry was that the radiation belt from Jupiter was messing with the system, but maybe you’re right.’

‘What?’ I ask. ‘You think I’m right about the moon melting?’

‘No,’ Rachel chuckles. ‘I mean, I think you’re onto something about the moon. The answer is *here*. Our ancestors were the oldest living culture on Earth. They survived for thousands of years because they listened to the land. We need to do the same here. We have to listen to Callisto. She’s telling us she’s sick.’ Rachel leans into me. ‘Last week I trailed one of the waste trucks to the outer regions. Something’s wrong, because the recycling facility was dead. There were no aircraft and no activity inside that Masie could detect. The lights were off. The waste truck continued past the centre.’
‘What are you saying?’

‘Nothing,’ Rachel says. ‘I just have a hunch.’

Rachel takes her tablet device from the pocket of her suit. She places it on the table. Lines and shapes cover the tablet screen in spirals and strokes.

‘Feel like going on an adventure?’ Rachel asks me. I nod.

We fasten our helmets and head back to the Explorer. Rachel has the glint in her eye that tells me she’s excited about something.

‘So, where are we going?’ I ask.

‘There’s this network of caves I found two years ago, when I first started at the research centre,’ Rachel says. She follows the digital map on the navigator and we drive away, along the road and further from the base. ‘I was trying to map them, but then I was ordered to stop. They didn’t give me much more of a reason than it's unsafe. I’ve always wondered why.’

Rachel drives us to the side of one of the craters.

We park and ahead of us I see the entrance to the cave. Rachel is first out of the Explorer with her backpack. I follow her and Masie.

Rachel ignites her torch and we walk into the cave. Darkness quickly falls all around us.

‘We need to start listening to Callisto,’ Rachel says again.

‘It’s a dead moon,’ I say. My voice echoes inside my helmet.

‘So they said,’ Rachel replies. ‘We know that the surface has no activity, but beneath, there’s a whole world to explore.’

The cave slopes downward. Rachel’s steady as she follows the path, but my boot slips and I skid along the icy ground. I knock Rachel and we slide down the tunnel like a slippery dip. Masie’s lights come on as she rolls behind us. Rachel’s torch disappears into a dark hole and I fall down another with Masie right behind me.

Masie grips a spike and stops above me. I slide further down but I reach out my hand and manage to grip a rock.

I’m hanging from the rock, trapped in the dark tunnel.

‘Rachel!’ I call out. ‘Rachel!’

There’s no answer. The light from Masie brightens in the tunnel and small pieces of ice pitter-patter over my suit.

‘Are you hurt, Tanner?’ Masie asks. My heart is pounding in my chest and my fast breathing is fogging my helmet.

‘No, I’m okay,’ I reply. ‘Where’d Rachel go?’

‘She fell down another chute. I’m tracking her now.’

The light on Masie’s chest dims, then brightens, then dims.

‘I’ve located her,’ Masie says. ‘We must continue down the pathway.’

‘No way!’ I say.

A splintering sound rings out beside my head. I turn to see the ice cracking like an egg. A piece of it chips away from the wall.

There’s something moving where the crack has formed. It breaks through the next layer of ice. It’s small but meaty, and wriggly. Its skin is white with tiny black spots. It looks like something I saw in one of our Earth Studies classes – like a worm.

My eyes open wider than they’ve ever opened before and I worry my eyeballs might fall out. I’m still. I don’t want to move in case I scare it. The light glistens on its slimy-looking skin, like melting ice. I grip the rock tighter and gaze at the Callisto worm.

‘Life beyond Earth,’ Masie says. ‘*Natural* life beyond Earth.’

The worm springs onto my helmet. The surprise makes me lose my grip on the rock and I slide down the tunnel. Masie falls after me and grips the suit at my chest. Her other arm spears the wall and she holds me there. More ice begins to split beside us and another worm leaps onto Masie’s body, then another and another.

The worm on my helmet is stuck right above my eyes. Its mouth opens and its small teeth bite at my helmet. I scream and Masie releases her hold on the wall.

We continue sliding down the tunnel. The worm on my helmet detaches. Masie crashes into me and her lights are like sparks in the blackness. We roll and slide and then we fall.

I land bum-first. Masie lands beside me. My back stings hot but I don’t have time to be hurt. The worms fall from the tunnel and rain down on us. I use my elbows to lift myself up and struggle to my feet. I shuffle backwards as the worms begin to slither along the icy ground. They’re not interested in me anymore, though. I watch them as they wriggle slowly away towards the shadows.

I hear the scuff of a boot and the beam of a torch appears. Rachel is standing in the far corner of the cave. Frozen icicles stand spiky along the ground and hang from the ceiling.

I race towards her, pointing to the ground behind me. ‘Rachel, there are worms here! Have you seen them?’ I say.

‘They’re harmless,’ Rachel replies. ‘We’ve known about them for a while. We thought they were dead all this time, but they’re alive.’

Rachel removes a container from her bag and places the open side over one of the worms. She slides the lid underneath and packs the worm into her bag. ‘They’re not used to the temperatures. It’s not as cold as it once was. The temperature of Callisto has risen since humankind arrived here, and that must be how they’ve woken up.’

Nearby, Masie moves towards one of the walls, and her light penetrates the ice. There, frozen within it, I can see cans and bags, bottles, old food scraps. Rubbish.

‘Disgusting, isn’t it?’ Rachel says. ‘The recycling facility is out of order, just as I thought. They’ve been using the caves to dispose of waste.’

She takes out a pickaxe and hammers it into the ice floor. ‘I think I’ve figured out why sickness is ravaging the outpost.’

She makes a hole in the ice, and beneath is slow-flowing, gel-like water.

‘The underground ocean of Callisto?’ I ask. Rachel nods. She removes a netted pan from her backpack and lowers it into the water. Water flows through the net steadily.

‘The filtration system grandma and grandpa made purifies the water from the underground ocean so that it can be drinkable. It remodels the water molecules to copy the fresh water from Earth. But the water doesn’t change without these.’

Rachel removes the pan from the water. Caught within the netting are small rocks, half the size of my pinkie fingernail.

‘What are those?’ I ask.

‘Callisto crystals,’ Rachel says. ‘They’re kind of like a *technician* for the water here. The crystals tell the water how to behave. When we modify the crystals with our coding, they tell the water how to change so that we can drink it. The crystals glow, in their natural state.’

I take one of the crystals from the net and hold it in the palm of my glove. ‘These aren’t glowing,’ I say.

‘No. It’s like they’ve lost their power.’

‘They’re dormant,’ Masie says.

Rachel rushes to the cave walls, shining her light over the waste frozen into the ice. She follows the trail downward to the corner of the cave. ‘It’s us,’ she says. ‘It’s our waste that’s shutting down the crystals. They’ve gone to sleep, because they’re not coping. And because the crystals are sick, so are the people who drink the water.’

‘That’s why everyone’s getting sick?’ I ask. Lights flash from Masie’s eyes over the crystals, then the walls.

‘Masie’s taking photographs,’ Rachel says. ‘We’ll show them to the research centre. These photos are our proof that the waste recyclers have been storing our waste in the caves instead of recycling.’ Rachel places the crystals into the small pouch of her backpack.

‘If these crystals are what is making people sick, there must be a way to use them to make people better,’ I say.

‘It’s possible,’ Rachel replies. ‘There’s a purifying power in these crystals. We’ll learn how to harness it.’

Masie detaches two ropes from her back casing, and Rachel and I hold onto them as Masie climbs to the surface. We load back into the Explorer and start for the research centre. Rachel steers us around the cave crater and we head onto the road. I think about that boy at school who was sick this morning. So many people are sick.

We’ll get the caves clean. We’ll get the crystals glowing again. The worms will return to their place in the ice and the sickness in the outpost will end. When I get back to school, I’ll remember that boy’s name. I’ll make sure of it.

Proof is the fourth story in The Callistan Cycle as part of Imagining The Future.

Proof by Gary Lonesborough
Story Editor Kate Whitfield
Artwork by Aaron Kennedy

Imagining The Future is a program of Future You.

See you in the future!

FUTURE
you


EARTHBOUND
by Alison Evans

EARTHBOUND

by Alison Evans

When I see Earth for the first time it looks exactly how it does in the pictures, like a blue and white marble. As we get closer, the continents reveal themselves in shades of green and yellow.

‘Look, Pen! Isn’t it beautiful?’ Dad says, leaning across me to peer out the window as we really start to descend. ‘It looks even better than I remembered it.’

‘Stay in your seat,’ I mimic back what he said to me when we first took off from Callisto two days ago.

‘Pen,’ he scolds, but he doesn’t mean it.

‘Passengers, please remain in your seats until the no-seatbelt sign has been switched off,’ the overhead announcement comes, and we grin at each other.

We touch down with barely a rumble and Dad gives me one of his Significant Looks. ‘You’ll remember this forever,’ he says.

‘Dad, I know.’

‘This is our home,’ Dad says.

I roll my eyes. ‘Dad! I know.’

I open my messages cause I said I’d ping my best friend Nerida as soon as we landed, but my dev won’t connect to the Earth web. I turn it off and on again, run a quick diagnostic, but nothing.

‘Oi Dad, is your dev working?’

He taps at the screen, then frowns. ‘No. Weird …’

‘What if something is wrong at home?’ I say, my heart beating faster. ‘The radiation wave was coming, what if something bad happened? I told Nerida I would message her as soon as we got here to make sure she’s okay.’

Dad sighs. ‘They’ll be okay – remember when there was the big radiation spell when you were seven? It happens, and we knew Jupiter’s radiation was going to be extra strong this week.’

I shudder, remembering the brownouts. But why would our devs be affected? With a knot in my stomach, we keep going.

The gravity’s stronger on Earth and it takes a few steps to feel like I can walk properly – I hear the motor in Dad’s wheelchair turn up a bit to compensate. ‘

Just like I remember,’ he says. ‘Come on, let’s go.’ He leads us away from the terminal to be Welcomed to Country.

After that, we get the drones to take our bags to our accommodation and head to the spaceport train station. It’s open to the Earth air and it’s so warm. Nothing like the perfectly conditioned air of Callisto’s domes – there’s no dome! I move a bit closer to Dad as I look up at the open sky and my heart starts beating faster. It’s scary, but kind of cool, and I breathe deep to relax. There are so many smells and I don’t recognise any of them. The train rail’s above us, and below the tracks is a carpet of green. I see a furry little animal scurrying away and I yelp – it’s the first wild animal I’ve ever seen. Not to mention how many insects there are buzzing around like jewels in the air.

‘Train’s coming.’

The train glides up silently. Dad leads us onto it and picks a spot near the window, I sit opposite him. As we move away from the spaceport the sky opens up and I gasp at the blue wideness of it. The clouds are puffy and white, tall mountains of what I know is water, but I don’t understand how it could be.

‘Southern Cross is only a couple of minutes away – that’s the station in central Naarm,’ Dad says. ‘The one Valli works at.’

As the train moves I can’t tear my eyes away from the sky. A flock of cockatoos passes by and my chest swells. I’ve seen them on screens but it’s different seeing them out where they’re meant to be, flying free and wild and real.

Soon skyscrapers and eucalypts block most of the sky from view, and the greenery becomes denser the closer we get to our destination. Even through the train windows I can hear the birds calling. With all this, I wonder how home is going, quiet in the radiation wave.

I try to get into my messages again but the signal isn't being picked up. There's just a weird static in my feed.

'We can see if there's a patch near Valli's,' Dad says when he sees me tapping at the screen. 'Maybe we just need to reconnect to the Earth web.'

'That shouldn't matter.' I frown. 'And anyway, it's the whole dev! Not just messages. Look, the time's all wrong and everything.'

The train empties almost completely when we get to Southern Cross and everyone's bustling around, on devs and screens, chatting to each other. As we leave the elevator, the scent of cooking fungi chips hits me and my mouth waters. I look around for Dad's cousin Valli, but they're not here yet.

There are heaps of different trains, the ones that go across the continent as well as the local lines. Most of them are two storeys. Callisto doesn't really have transport like this; the gravity means it's easier to make things hover. Valli works with the timetabling, making sure every train has a spot to park when it passes through.

'Why don't we get chips while we wait for Valli?' Dad says.

The crunch is the same but the taste is different. Better? I'm not sure. Eventually, we see Valli across the train station, and their kid Jaya is with them. They're my age and we've met a couple of times on holo.

They wave at me and I wave back. Dad and Valli start yacking away as we start towards their apartment. They live just above the station.

'Have you heard anything from Callisto?' I ask.

Valli shakes their head. 'Not since the radiation started getting worse. But that's normal, right?'

'It's not unexpected,' Dad says. 'When I first moved to Callisto there was a whole week we didn't have any communication with Earth. Everything was fine, the Masies had it all under control.'

I swallow and nod.

‘By the way, don’t call any of the androids here Masies,’ Valli says to me and Dad. ‘It’s not something they like. On Earth they’re citizens, they’ve been delinked from the central AI. Just ask for their names like you would anyone else.’

‘Thanks Valli,’ I say, grateful they’ve told us before I messed anything up.

‘So you have to tell me everything about Callisto,’ Jaya says as we head towards the elevators. ‘Everyone at school thinks it’s cool that you live there.’

I don’t tell them that everyone in my class thought it was so uncool that I was going to Earth for the holidays. ‘It’s way warmer here. The gravity is weird though. I feel really tired and we’ve barely been here an hour!’

‘Can you float on Callisto? Kat reckons she went there and she floated but I reckon she was lying.’

I laugh. ‘No, we don’t float. The base only has a little less gravity than here but I guess I just didn’t think I’d notice the difference.’

‘I can’t wait for a coffee,’ Dad says as we wait in front of the elevators.

Valli crosses their arms and rolls their eyes. ‘You’re in Naarm and you want replicator coffee? Come on, I’m showing you the best spot.’

Valli drags us away from the elevators. As we use one of the walkways to cross the street, more birds fly overhead.

‘It’s so strange, so many animals everywhere,’ I say to Jaya.

They frown. ‘Aren’t there animals on Callisto?’

‘Not like this. I mean, some robos are animal shaped. But there aren’t any wild animals around. I’ve never even seen any before today.’

Jaya shakes their head. ‘That’s a shame.’

We get to the cafe, in a skyscraper covered in vines and other plants. Out on the balcony a few birds are feeding on flowers.

When our drinks come, Dad smacks his lips after the first sip.

‘Not bad,’ he says. ‘Callisto’s is still better. There’s nothing like hydroponic coffee beans.’

Valli laughs and shakes their head. ‘I’m sure it’s all true.’

By bedtime there’s still no news from Callisto. I tap my dev and the screen lights up with static again. I try everything, and Jaya even tries the emergency hotspot. It’s like the one we have back home that everyone can access just in case the network goes down. It does on Callisto sometimes because of the radiation, but Earth’s hasn’t been down since before Jaya was born, they reckon.

I groan and unstrap my dev from my wrist, chucking it across Jaya’s room.
‘
Do you want me to have a go?’ Jaya asks, their eyebrows knitted.

‘Sure, but I think it’s hopeless,’ I say, sighing.

‘Is it making any weird sounds?’ Jaya picks the dev up off the floor.

I shake my head. ‘Haven’t checked. It’s always on silent.’

Jaya opens messages and turns up the volume as we watch the static. At first I can’t hear anything, but after a moment I think I hear something low, pulsing.

‘Can you hear that?’ I whisper.

Jaya turns up the volume a little. ‘What is it?’

‘I dunno.’ It’s sort of rhythmic, like a heartbeat but not as regular. I can’t shake the feeling that there’s something else; we’re missing parts of it.

We’re silent for a few moments, but Jaya shakes their head.

‘Maybe our parents will know,’ Jaya yawns.

‘I guess we should sleep,’ I say, yawning too. ‘Dad’s got a hectic schedule for us tomorrow.’

As I try to sleep, thinking about the sound and the static, I listen to the possums on the balcony, the chirping of bats outside. The sky's so clear and the stars are all different. I wasn't prepared for that. The trains sound a bit like the enviro stabilisers on Callisto when you're up real close, and the rhythm of that helps me drift off.

We get up early and the sunlight streaming in is beautifully warm – Jaya says they get their electricity from the windows.

'You're up early,' Dad says, pretending to be shocked. 'I didn't even have to drag you out.'

'Da-ad,' I say, cheeks warming, but Jaya doesn't seem to notice. 'No news from home?' I hope they're doing okay, and wonder if Nerida's warm enough. I remember being cold when we went through the radiation burst when I was little. The radiation waves sometimes mess with the temperature regulators. It doesn't take long for the Masies to fix, but sometimes it's a few hours.

He shakes his head. 'Not yet. But we've got a big day of sightseeing ahead of us,' he says, clapping his hands together. 'I've made us a schedule.'

I groan and make eye contact with Jaya, who giggles.

'My dev's making a weird noise, Dad. Is yours?'

When he opens his dev to the same place as mine, it's making the same rhythmic noise that sounds half-empty.

He frowns. 'Odd. Very odd.'

Dad drags me and Jaya around the city while Valli's at work. We go to the launching place where the Kaufman family left Earth all those years ago, then we go to the aquarium, and three different cafes. All the while I'm checking my dev for any change, but it's way too loud outside for me to hear anything and I can't tell if the static is the same or not. We're out all day until Valli messages to say we're invited to the communal dinner on the rooftop when we get back.

The rooftop is a bunch of picnic tables surrounded by a garden with fruit trees and veggies growing. I trail my hand through some basil and pause. My mouth waters at the smell; it's so fresh and real.

Me and Jaya scoff our food and then they show me the telescope. It's a pretty big one, and we look up at the stars. 'Deneb, one of the androids that lives in our building, they showed me all this stuff, taught me about the stars,' Jaya says. 'They're working on some paintings of the sky; sometimes they work up here.'

'At home Jupiter's always in the sky. It's nice to see so many stars.'

'We can see Jupiter from here with just our eyes, didja know that?' they ask, pointing. 'It looks like a big red star but it doesn't twinkle. You see it?'

It takes me a second. 'Wow.'

'Here.' Jaya motions for me to look through the telescope and I can see Jupiter in more detail. 'With more magnification you'd be able to see Callisto.'

I go to take a picture, then remember my dev isn't working so I can't send it to Nerida anyway. 'Take a picture for me?'

As Jaya points their dev into the telescope, I gasp. 'We need to magnify it. My dev! We have to boost the signal. On Callisto when there's a brownout, the Masies boost the web stations, or the scanners, or whatever we need if it's important. What if my dev is receiving something but isn't powerful enough to display it properly? Something from Callisto.'

I don't know if it's really a signal, but I have a hunch.

'We should ask Deneb, they know way more about tech stuff than anyone I know. They might know what to do.'

Jaya sends them a message; they're on duty at the station, so we get permission from our parents to go down to meet them.

An owl flies overhead. The station's lit dimly so that birds know it's night-time, but enough that we can see where we're going.

We pass rows of rural trains waiting in their homes; one of them will be crossing the continent. As we walk the width of the station, metro trains pass us above and below the walkways.

Jaya introduces me to Deneb when we get inside the office and I show them my dev. They scan it, but shake their head.

‘I think you’re right, it is some kind of signal,’ Deneb says. ‘But maybe we need something to help it amplify it …’

‘Do you think it’s because it’s from Callisto?’ I ask. ‘The same thing is happening to my dad’s dev as well.’

‘That could be possible.’ They frown.

‘Do you know any androids from Callisto? Maybe they could help.’

Deneb looks at the clock displayed on the window. ‘I finish in half an hour, I’ll message my friend Arcturus. She came to Earth a few years ago but was made on Callisto. We’ll meet on the roof.’

Me and Jaya go up to the roof again. There are still a few people milling around, but dinner is all packed up. Dad and Valli say we can stay up here for a bit longer; Jaya manages to convince them we want to keep using the telescope.

As we wait for the androids, my stomach fizzes with anticipation. Jaya’s feet swing back and forth on the bench we’re sitting on. There’s a wet, squishy sound and I look around to see what it is.

‘Bats,’ Jaya says, pointing. ‘They love the fruit trees.’

As the elevator doors open, the static sound on my dev sharpens a little, becomes louder. Deneb and their friend come towards us.

‘Looks like my arrival changed something – you were right,’ Arcturus says to me. We introduce ourselves and I give her the dev. The sound is more rhythmic now.

‘What’s going on?’ I ask.

‘I think your dev and my body have some Callisto-specific metals inside them. Combined with something about Earth, we’re able to receive it.’

‘Could the gravity be a factor?’ I ask.

‘It could be any number of things,’ Arcturus says. She closes her eyes. ‘I’m going to try and piggyback off one of the satellites.’ After a few seconds, more layers begin to emerge from the static. All different sounds coming together in harmony. And then I realise.

‘It’s a song.’ I laugh. ‘A very strange song.’

‘Can you tell where it’s coming from?’ Jaya asks. ‘Callisto?’

I know before Arcturus shakes her head that it’s not from home. Callistan music doesn’t sound like this.

‘No,’ Arcturus says. ‘It’s coming from beyond Callisto, much further.’

‘Beyond?’ I ask. ‘But we haven’t been further than Callisto yet.’

‘That’s right.’

My breath hitches. ‘You mean … it’s someone else?’

Arcturus smiles. ‘It would seem so.’

My dev lights up in Arcturus’s hands and dozens of messages are coming through from Nerida from the last couple of days.

Can you hear it?

Pen!!!!

This is the WORST time for you to go on holidays

The radiation did something to the station’s receptors and we’re getting a message from somewhere near Sirius. That’s LIGHT YEARS away!

I look up at the stars above and there are thousands, with so much space between them. How many solar systems, galaxies, beings are out there? Whoever they are, I think, they sent us a gift in the form of a song.

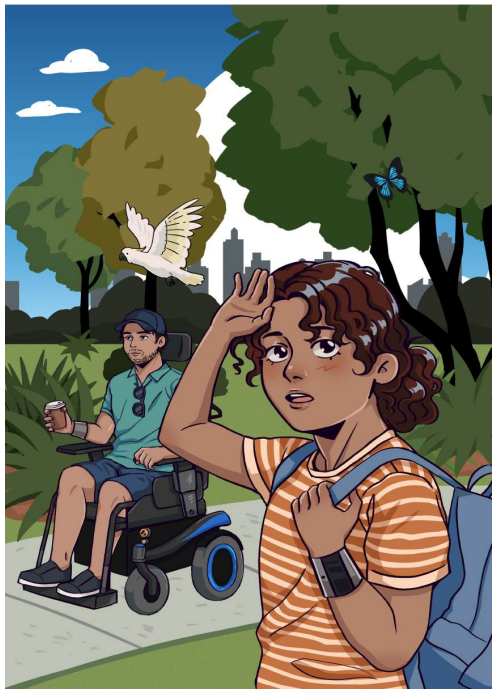
For now, we listen.

Earthbound is the final story in The Callistan Cycle as part of Imagining The Future.

Earthbound by Alison Evans
Story Editor Kate Whitfield
Artwork by Christine Le

Imagining The Future is a program of Future You.

See you in the future!



FUTURE you

Imagining the Future Activity Matrix

This activity matrix can be used with any of the stories that you choose from the Callistan Cycle series of five, available on the Future You website under Imagining the Future. Each story is available in audio, audiovisual or text format to suit the needs of your individual students.

This activity matrix is directly linked to Bloom's Taxonomy and Gardner's Multiple Intelligences. The Blooms Taxonomy and Gardner's Multiple Intelligences activity matrix includes a wide range of activities for your lesson plans that cover multiple areas and year levels in the Australian Curriculum V9.0 (please see pages 4–7) and can be used with any of the five stories from the Callistan Cycle.

The matrix allows students to develop their critical thinking and creativity skills. It caters for learner diversity and individual differences/learning styles. Students can work on activities at their own pace, or the teacher can set specific activities that need to be completed.

As we want our students to produce high-quality work, experience success and develop a sense of pride, we suggest discouraging students from rushing through all of the activities. They should be worked at slowly and gradually, even over several weeks. Points systems can be implemented to help with this. To promote fairness and inclusivity in the classroom, we recommend implementing a points system that assigns equal value to all activities regardless of their level within Bloom's Taxonomy. Instead of awarding more marks to 'higher order' activities, we suggest awarding the same points for completion of each task. However, you can still differentiate the marks based on effort and learning outcomes, assigning a range of 1 to 5 marks per activity for individual students. This approach fosters a sense of worth for all students and ensures that academic achievement is not the sole determinant of value in the classroom. By implementing this system, you can avoid rewarding only the academically advanced students and instead recognise the accomplishments of all students, irrespective of their academic strengths.

Gardner's Intelligence Styles	Bloom's Taxonomy					
	Knowing	Understanding	Applying	Analysing	Creating	Evaluating
Verbal I enjoy reading, writing & speaking	Write a brief summary of one of the stories, including key characters and major events.	Write a paragraph explaining the main theme or message conveyed in the story.	Write a letter from one character to another, applying the story's concepts and events to a personal situation.	'We should only use robots for work.' Write a persuasive letter in response to this statement. Do you agree or disagree?	Write an alternative ending to or continuation of the story, exploring new possibilities and resolving unanswered questions.	What would the world be like if space didn't exist and the earth was flat? Evaluate possible problems that could occur.
Mathematical I enjoy working with numbers & science	Create a timeline of important events in the story, labelling each event with the corresponding time or date.	Write a persuasive letter to a friend that tells them why Maths is the best subject at school.	Find some statistics on space and space travel that interest you. Here is one idea: • *How fast does a rocket need to travel to get off Earth?*	Identify and explain what you think are the most important parts of maths used within the story? How would the outcome of the story be different if maths wasn't available?	Invent a new gadget or technology that could benefit space exploration by measuring something, describing its functions and advantages.	Develop a rating system for sci-fi stories, including criteria such as plot, character development, scientific accuracy and originality, and use it to evaluate the story.
Visual/Spatial I enjoy painting, drawing & visualising	Draw and label an image to describe what a software engineer or a mathematician looks like. Try to give a really good description.	Create a visual representation, such as a mind map, bubble diagram or family tree, illustrating the relationships between different characters in the story.	Draw a flow chart showing the environmental impacts on Callisto of not properly disposing of waste (like in Proof).	Draw and label two different spaceships, using the story to help inspire your drawings, then compare and contrast the two, identifying similarities and differences.	Draw a billboard poster advertisement to encourage families to sign up to live on the lunar outpost on Callisto.	Compare picture one and picture two. Which one do you prefer and why? What is good and what is not so good about each of them?
Kinaesthetic I enjoy doing hands-on activities, sports & dance	Create a physical movement sequence or dance that represents the journey of the main character in the story.	Act out a scene from the story using improvisation, incorporating body movements and gestures to convey the emotions and actions of the characters.	Collaborate with classmates to create a short skit or play based on a pivotal scene from the story, using props and costumes to bring the setting and characters to life.	Create a tableau or frozen scene depicting a key moment in the story, with classmates playing the roles of different characters and using body positioning and facial expressions to convey emotions and relationships.	Create a visual collage or digital artwork that combines elements of the story, such as characters, planets and spaceships, into a cohesive composition.	Create simple puppets for the story and act out two scenes that compare and contrast emotions.

Gardner's Intelligence Styles	Bloom's Taxonomy					
	Knowing	Understanding	Applying	Analysing	Creating	Evaluating
Musical I enjoy making & listening to music	Compose a short musical piece or jingle that captures the essence or mood of the space setting in the story.	Choose a character from one of the stories. Write a short song about that character.	Write a list of musical instruments someone could play wearing a spacesuit. List how they would play each instrument with the restrictions a spacesuit would have.	Analyse the musical motifs and sound effects in the audio story, discussing how they enhance the storytelling or character development.	Compose a song or musical piece that serves as the anthem or theme song for a particular group or organisation mentioned in the story.	Evaluate the effectiveness of the musical choices and sound effects in the audio story, discussing how they contribute to the overall experience and add emotional impact.
Interpersonal I enjoy working with others	Engage in a class discussion or group conversation about the story, sharing personal reactions and interpretations. *or* Write a letter to one of the characters from one of the stories.	Participate in a small-group activity where each group member shares their understanding of a specific character from the story, discussing the character's motivations and actions.	Collaborate with a partner or small group to create a role-play scenario based on a conflict or dilemma faced by characters in the story, discussing and negotiating different perspectives.	Engage in a debate or structured discussion with classmates, exploring different interpretations of a key event or decision in the story.	Collaborate with classmates to create a story or an alternative ending to the story, incorporating everyone's ideas and perspectives.	Engage in a structured peer feedback session, where classmates provide constructive criticism and support regarding each other's written analyses or interpretations of the story.
Intrapersonal I enjoy working by myself	Write a recap of the story, including which bits you liked the most and least.	Write a story with the title 'How does an astronaut prepare for life in space?'	Write step-by-step instructions for how to put on a spacesuit if you want to go for a spacewalk.	Which robot animal (like in Semper) would make the best pet for an elderly person? Explore the pros and cons of this choice.	Earth needs you: all the communications are down! Can you create a new way for people to communicate? How will it be used and why should people use it?	If you were forced to spend the rest of your life in a space transport, a lunar outpost or on earth, which one would you choose and why? Evaluate the good bits and bad bits of living on each.

Australian Curriculum Links

Please note: Each individual activity in the matrix does not cover every curriculum code. We recommend you use your professional judgement to ensure your students are choosing a spread of curriculum-aligned activities.

English Understanding

Subject	Codes	Description
Year 3		
Language	(AC9E3LA01)	Understand that cooperation with others depends on shared understanding of social conventions, including turn-taking language, which vary according to the degree of formality.
	(AC9E3LA05)	Identify the purpose of layout features in print and digital texts and the words used for navigation.
	(AC9E3LA10)	Extend topic-specific and technical vocabulary and know that words can have different meanings in different contexts.
Literature	(AC9E3LE01)	Discuss characters, events and settings in different contexts in literature by First Nations Australians and wide-ranging Australian and world authors and illustrators.
	(AC9E3LE02)	Discuss connections between personal experiences and character experiences in literary texts, and share personal preferences.
	(AC9E3LE05)	Create and edit imaginative texts, using or adapting language features, characters, settings, plot structures and ideas encountered in literary texts.
Literacy	(AC9E3LY01)	Recognise how texts can be created for similar purposes but different audiences.
	(AC9E3LY02)	Use interaction skills to contribute to conversations and discussions to share information and ideas.

	(AC9E3LY06)	Plan, create, edit and publish imaginative, informative and persuasive written and multimodal texts, using visual features, appropriate form and layout, with ideas grouped in simple paragraphs, mostly correct tense, topic-specific vocabulary and correct spelling of most high-frequency and phonetically regular words.
	(AC9E3LY07)	Plan, create, rehearse and deliver short oral and/or multimodal presentations to inform, express opinions or tell stories, using a clear structure, details to elaborate ideas, topic-specific and precise vocabulary, visual features, and appropriate tone, pace, pitch and volume.
Year 4		
Language	(AC9E4LA10)	Explore the effect of choices when framing an image, placement of elements in the image and salience on composition of still and moving images in texts.
Literature	(AC9E4LE05)	Create and edit literary texts by developing storylines, characters and settings.
Literacy	(AC9E4LY05)	Use comprehension strategies such as visualising, predicting, connecting, summarising, monitoring and questioning to build literal and inferred meaning, to expand topic knowledge and ideas, and to evaluate texts.
	(AC9E4LY06)	Plan, create, edit and publish written and multimodal imaginative, informative and persuasive texts, using visual features, relevant linked ideas, complex sentences, appropriate tense, synonyms and antonyms, correct spelling of multisyllabic words, and simple punctuation.
	(AC9E4LY07)	Plan, create, rehearse and deliver structured oral and/or multimodal presentations to report on a topic, tell a story, recount events or present an argument using subjective and objective language, complex sentences, visual features, tone, pace, pitch and volume.
	(AC9E4LY08)	Write words using clearly formed joined letters, with developing fluency and automaticity.
	(AC9E4LY11)	Read and write high-frequency words, including homophones, and know how to use context to identify correct spelling.
Year 5		

Literature	(AC9E5LE01)	Identify aspects of literary texts that represent details or information about historical, social and cultural contexts in literature by First Nations Australians and wide-ranging Australian and world authors.
	(AC9E5LE02)	Present an opinion on a literary text using specific terms about literary devices, text structures and language features, and reflect on the viewpoints of others.
	(AC9E5LE05)	Create and edit literary texts, experimenting with figurative language, storylines, characters and settings from texts students have experienced.
Literacy	(AC9E5LY02)	Use appropriate interaction skills including paraphrasing and questioning to clarify meaning, make connections to own experience, and present and justify an opinion or idea.
	(AC9E5LY06)	Plan, create, edit and publish written and multimodal texts whose purposes may be imaginative, informative and persuasive, developing ideas using visual features, text structure appropriate to the topic and purpose, text connectives, expanded noun groups, specialist and technical vocabulary, and punctuation including dialogue punctuation.
	(AC9E5LY07)	Plan, create, rehearse and deliver spoken and multimodal presentations that include relevant, elaborated ideas and sequencing ideas, and using complex sentences, specialist and technical vocabulary, pitch, tone, pace, volume, and visual and digital features.
Year 6		
Language	(AC9E6LA01)	Understand that language varies as levels of formality and social distance increase.
Literature	(AC9E6LE01)	Identify responses to characters and events in literary texts, drawn from historical, social or cultural contexts, by First Nations Australians and wide-ranging Australian and world authors.
	(AC9E6LE05)	Create and edit literary texts that adapt plot structure, characters, settings and/or ideas from texts students have experienced, and experiment with literary devices.

Literacy	(AC9E6LY02)	Use interaction skills and awareness of formality when paraphrasing, questioning, clarifying and interrogating ideas, developing and supporting arguments, and sharing and evaluating information, experiences and opinions.
	(AC9E6LY05)	Use comprehension strategies such as visualising, predicting, connecting, summarising, monitoring and questioning to build literal and inferred meaning, and to connect and compare content from a variety of sources.
	(AC9E6LY06)	Plan, create, edit and publish written and multimodal texts whose purposes may be imaginative, informative and persuasive, using paragraphs, a variety of complex sentences, expanded verb groups, tense, topic-specific and vivid vocabulary, punctuation, spelling and visual features.
	(AC9E6LY07)	Plan, create, rehearse and deliver spoken and multimodal presentations that include information, arguments and details that develop a theme or idea, organising ideas using precise topic-specific and technical vocabulary, pitch, tone, pace, volume, and visual and digital features.

FUTUREYOU

Imagining the Future of Careers in Space

Find your space in Australia's future space workforce

Developed in partnership with Australian Space Agency

Where could your future take you?

Do you enjoy solving problems and working with others?

Are you interested in making the world a better place, or discovering the secrets of the universe?

A career in space might be perfect for you!

Learn about the many exciting jobs available in Australia's space industry and discover jobs that match your interests.

Start dreaming about your career today.

I want to:

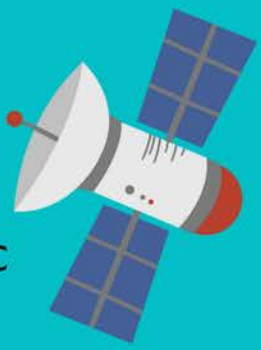
be part of teams that design, build and test spacecraft and systems.

You could be...

A Space Systems Engineer

They design, build and test spacecraft, launches and ground-based systems.

An Electrical, Electronics and Avionics Engineer



They design, construct, install and maintain electronic and electrical systems, including communications, navigation and control.

A Robotics Engineer

They build, install, operate, test and maintain robots, robotic components, devices and systems.

I like to:

create breakthroughs in our understanding of space and work individually, or in teams, to research.

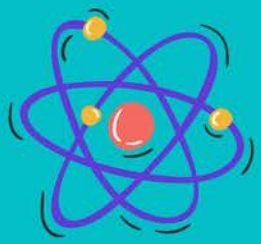
You could be...

A Rocket Propulsion Scientist

They design, test and manufacture spacecraft propulsion systems using scientific and engineering knowledge.

A Space Scientist

They apply the laws of physics, chemistry and geology to understand the universe.



A Flight Surgeon

They support the health, safety and wellbeing of astronauts, using medical science and technology to prevent and control hazards.

I like:

working in a team, using cutting-edge technologies, to develop new processes and pathways to overcome challenges.

You could be...

A CAD Drafter and Designer

They use computer-aided design to create and modify 2D and 3D designs and drawings.

An Engineering Technician

They design, build and test equipment, conduct experiments, collect data, and identify and solve complex problems.

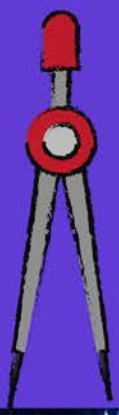
An Engineering Technologist

They analyse, modify, test and apply new and existing engineering technologies to solve complex issues in consultation with engineers.

I want to:

machine and assemble parts and components for spacecraft, satellites and other systems as part of Australia’s future in space.

You could be...



A CNC Machinist

They interpret and use technical drawings and designs and set up, program, operate and oversee industrial machinery, milling machines and tools to create precision metal parts.

A Mechanical Technician

They install machinery, parts and equipment in aircraft and spacecraft.

An Assembly/Assembler Technician

They construct, assemble, fit, fasten and install parts in aeroplanes, spacecraft and satellites.

A Production Test Technician

They monitor, adjust and test processes and equipment in the production environment.

I want to:

install, test and repair electronics, communications and control systems, and set up, monitor and repair automated and robotic systems.

You could be...

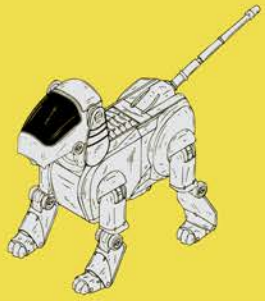
An Avionics Technician

They install, inspect, test, adjust and repair electronic equipment in aircraft and spacecraft.

An Electrician and Electrical Technician

They construct, install, test and repair electrical systems, equipment and components.

An Automation and Robotics Technician



They assist engineers to build, install, operate, test and maintain robots, robotics components, devices and systems.

I want to:

gather and analyse big data, and develop software and simulations.

You could be...

A Computer Scientist, Data Scientist and Analyst

They collect, organise, interpret and report on data to get useful information for organisations.

A Software Developer and Software Engineer

They design, program, test, implement and maintain software systems

An Intelligent Game Developer

They build, program and use systems and games in virtual reality, augmented reality and simulations to analyse data, make intelligent decisions and interact with others in human-like ways.

I want to:

develop the ICT systems and build the cybersecurity frameworks that will secure the Australian space sector's future activities.

You could be...

A Network and Systems Administrator

They configure, install, maintain and protect software, hardware and the networks.

A Cybersecurity Specialist and Manager

They plan and implement security measures to protect computer networks and systems from cyber attacks.

I want to:

play a major role in the successful running of Australian space sector projects and missions.

You could be...

A Work, Health and Safety Officer

They look after health and safety systems, do risk assessments and advise managers and employees.

A Space Lawyer

They provide advice and prepare legal contracts and documentation to ensure everything is in line with Australian treaties and international laws.

A Space Business Development Manager

They identify, build and plan new customer and business proposals to find new business opportunities.

A Project Manager and Mission Manager

They plan and manage resources for projects to deliver on time and on budget.

I love space:

and want to communicate and design assets that educate the world about Australia's exciting and critical role in space.

You could be...

A Space Communicator

They promote or create a good image for people and space industry companies to increase awareness of their goals and achievements.

A Graphic Designer

They produce images, illustrations, videos, photos and animation to promote space concepts and companies.

An Education Outreach Officer

They plan and deliver educational activities for school and higher education students.

A Media and PR Officer

They build interest in companies with media, government and the public by creating advertising, events, social media, print-based and online content. They translate complex information into content everyone can understand.

For more information about these careers and other exciting careers in space, visit:

https://www.industry.gov.au/australian-space-discovery-centre/pathways-career-space

To see some of these careers brought to life, read the Imagining the Future story series at:

https://futureyouaustralia.com.au/imagining-the-future/

Developed in partnership with

Australian Space Agency

FUTURE you

www.futureyouaustralia.com.au